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LOCKPORT, N. Y.

THE FOUNDRY

ANNUAL
CONVENTION NUMBER

VOL. 38 No. 4 — CLEVELAND, OHIO, JUNE, 1911 — WHOLE No. 226

FOUNDRYMEN'S MEETING AT PITTSBURG

Report of the annual convention of the American Foundrymen's Association — Entertainment features and election of officers

IF THE recent convention of the American Foundrymen's Association and its allied bodies, which was held at Pittsburg, May 23 to 26, be compared with the first meeting, 15 years ago, the remarkable strides which have been made in foundry practice in the past few years, become evident. At the time of the first meeting, the molding machine was a curiosity and electrical equipment unknown; the American Brass Founders' Association and the Associated Foundry Foremen did not exist, while the idea of holding an annual exhibition of foundry appliances had not been conceived. The character of the recent meeting in Pittsburg was fully up to the standard which has been set in the past few years. The American Foundrymen's Association, the Brass Founders' Association and the Associated Foundry Foremen held professional sessions, at which a large number of interesting papers were presented, and the amount of attention devoted to steel foundry practice was noteworthy. Under the auspices of the Foundry and Machine Exhibition Co., the usual exhibit of modern foundry equipment was held. The professional sessions of the American Foundrymen's Association opened at 10 a. m., Tuesday. Major Joseph T. Speer presiding. Addresses of welcome were extended by representatives of the Pittsburg Chamber of Commerce and on behalf of Mayor Wm. A. Magee. The reply to the adresses of welcome was made by A. E. Howell, vice president of the American Foundrymen's Association. In a brief presidential address, Major Speer pointed out the great progress which has been made in the science and art of founding in the past few years, due largely to the co-operation and interchange of information among foundrymen. He also commented on the prevailing unsatisfactory business conditions in the foundry trade and expressed the opinion that normal activity would return in the near future.

MAJOR JOSEPH T. SPEER, RE-ELECTED PRESIDENT OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION

In his annual report, Dr. Richard Moldenke, secretary of the American Foundrymen's Association, called attention to the fact that the increase in the annual dues from $5.00 to $10.00 has placed the society on a sound financial basis, although the membership

Photograph by Johnston Studio, Pittsburg.

BANQUET TENDERED THE MEMBERS OF THE ASSOCIATED FOUNDRY FOREMEN BY THE PITTSBURG FOUNDRY FOREMEN'S ASSOCIATION AT THE FORT PITT HOTEL

has been slightly reduced. For the first time in the history of the association, the transactions have been sent to the membership in bound form and the report of the proceedings of the Detroit convention is recorded in a volume of nearly 500 pages. In reviewing the work of the year, Dr. Moldenke stated that much progress has been made in continuous melting and in the development of the permanent mold, and pointed out that great interest is being manifested in the utilization of waste materials in foundries. Progress was reported on the molding sand tests that are being conducted under the auspices of the association and thus far more than 1,500 separate tests have been made of 80-odd molding sands. The Ohio State Geological Survey has made a request that its 850 tests of molding sands be added to the report of the investigations of the American Foundrymen's Association. As it will require some time to digest and complete the work, a report of this investigation will be issued in the near future. The secretary announced a total membership of 692, but this will probably be reduced slightly when the present arrangement with the individual members of the Foundry and Manufacturers' Supply Association, which was recently dissolved, is terminated on July 1. The total receipts for the year amounted to $5,085.50, and with interest and the balance at the time of the Detroit convention, the receipts totalled $5,394.21. The balance on hand on May 20 was $1,-541.95.

Dr. Moldenke read a telegram announcing the death of W. W. Sly, of Cleveland, and a committee was appointed to draw up appropriate resolutions on the death of Mr. Sly and also Albert N. Spencer, of the Oliver Machinery Co., Grand Rapids, Mich., who were prominent members of the various foundrymen's organizations.

Low Cost Insurance for Foundries.

S. G. Walker, Providence, R. I., read a paper on "Low Cost Insurance for Foundries", which pointed out the advantages of the mutual system. He stated that mutual fire insurance companies are able to operate more economically than stock companies and are more careful in inspecting risks and have avoided congested districts where the danger of fire is multiplied. He also stated that the moral hazard in mutual insurance is practically negligible.

Ellsworth M. Taylor, New York, presented a paper on "Production Costs". Mr. Taylor's paper contained a formula for obtaining the actual cost of an individual casting, or group of castings. This formula is as follows:

(1) Multiply the weight of the casting or class by the cost of the net metals consumed.

(2) Add the cost of the direct labor used.

(3) Multiply the weight by the per pound unit, covering all indirect costs to be distributed on a basis of weight of good castings. These items are: Cupola cost, molding supplies, flask costs, core supplies and expenses, and all items of similar nature.

(4) Multiply the direct labor by the percentage unit covering all indirect costs to be distributed as a percentage of direct labor. These items are: Office and clerical charges; foremen, etc.; miscellaneous foundry labor and expenses; rent, and all items of a similar nature.

(5) Total the above amounts.

(6) Add a proper proportion of selling expenses.

The total is the gross cost of the individual casting or class.

Continuing, Mr. Taylor stated that the greatest commercial weakness of the foundry industry today is a lack of appreciation of sound business methods.

ROBERT B. THOMSON, RE-ELECTED PRESIDENT OF THE ASSOCIATED FOUNDRY FOREMEN

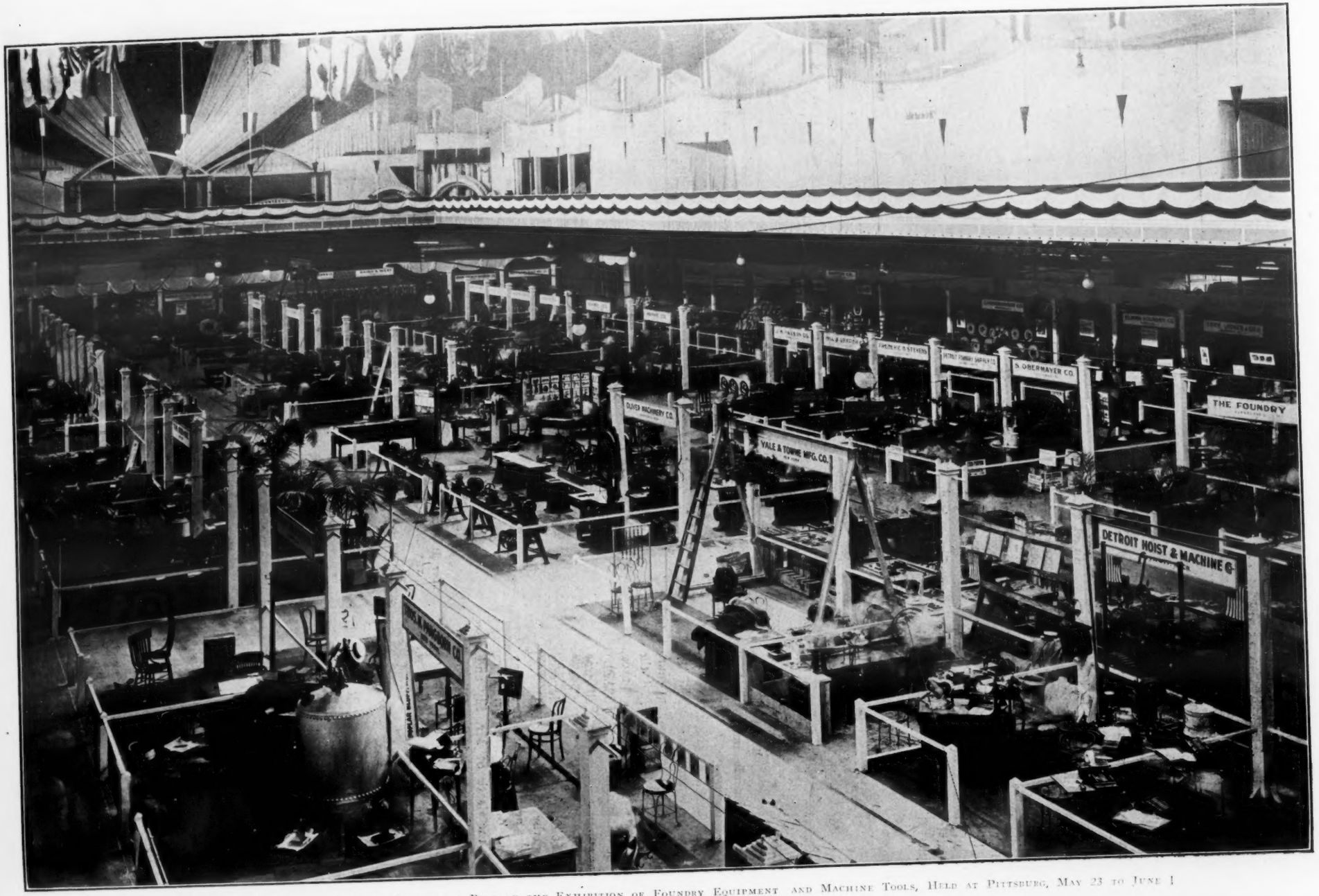
Competing foundries pay practically the same amount for labor and materials, but are woefully inaccurate in computing their overhead, or burden charges, often neglecting them entirely. For this reason the prices on a given set of castings will often vary over 200 per cent among five or six shops in the same town. Indifference to actual cost factors is responsible for these varying prices. It is necessary for the successful foundryman to watch his indirect expense continually and to have some accurate way of computing it.

Standard Test Bar for Cast Iron.

Dr. Richard Moldenke presented a "Memorandum on Standard Test Bars for Cast Iron", in which he called attention to the discussion of the arbitration test bar at the Copenhagen Congress of the International Society for Testing Materials. This test bar is 1¼ inches in diameter and 14 inches long, and is broken transversely on supports 12 inches apart. The comparison of practice showed, that so far as the diameter of the bar is concerned, there is a general accord, foundrymen and users of castings having finally concluded that as large a bar as can conveniently be handled on ordinary testing machines is the one to adopt. Germany, Italy and the United States have adopted the 1¼-inch bar and while England is favorably inclined, no official action has yet been taken on the subject. There also seems to be unanimity of opinion as to the manner of casting test bars on end in dry sand, although in Germany these bars are cast from the bottom. The radical difference in the several standards seems to lie entirely in the length of the bar. In the United States, the bar is 12 inches between supports, in Germany the bar is almost two feet long, while in Italy the length of the bar between supports is only six inches. It was, therefore, suggested at the Copenhagen Congress that a series of tests be made in the several countries interested, with bars ranging from 6 to 24 inches between supports and from the results obtained, the length be selected which will give the best general values. At the 1910 meeting of the American Society for Testing Materials, the results of a series of tests made in this country was reported by Walter Wood, of R. D. Wood & Co. Three series of tests were made on an average of nine bars each and the modulus of rupture of the bars tested on a 12-inch span was 45,930 pounds per square inch; 18-inch span, 44,570 pounds per square inch, and 24-inch span, 42,800 pounds per square inch. This indicates a steady downward progression of the modulus of rupture for cast iron, as the span increases.

Other Tests.

Ten sets of four bars, 1¼ inches in diameter and 26 inches long, were cast and these were broken on supports 14, 16, 18 and 20 inches apart. The composition of the metal follows: Silicon, 1.90 per cent; sulphur, 0.08 per cent; phosphorus, 0.75 per cent; manganese, 0.65 per cent; combined carbon, 0.55 per cent; graphitic carbon, 3.10 per cent, and total carbon, 3.65 per cent. The modulus of rupture of the 14-inch bar was 44,000 pounds per square inch; 16-inch bar, 43,800 pounds per square inch; 18-inch bar, 43,800 pounds per square inch and the 20-inch bar, 44,100 pounds per square inch. The difficulty, however, seems to lie in the fact that no tests of spans as low as six inches are available. With such results it would be possible to plot a curve, showing the relation of the span to the



A View in the Main Building, Showing a Part of the Exhibition of Foundry Equipment and Machine Tools, Held at Pittsburg, May 23 to June 1

modulus of rupture of the material, the turning point being found when too great a stiffness and consequent high results, change to too great a weakness or possible lack of sensitiveness on the part of the test on the other side. This point, when found for the several classes of iron, would be the desirable length of the span for the standard test. This series of tests should be extended by including those made on bars of smaller spans.

A partial report of the investigations of the committee on molding sand data was read by the secretary, and a method of analyzing molding sand on a rational and standard basis was presented. Other papers read at this session, but only briefly discussed, included "The Efficiency Movement in the Foundry", by C. E. Knoeppel, and "Weak Points of Cost Systems", by S. E. Nold.

Cupola Practice.

The Tuesday afternoon session was opened by two papers on "Cupola Practice", by P. Munnoch and R. H. Palmer. Mr. Palmer's paper contained a detailed explanation of a system of cupola operation employed in a large Ohio foundry. He contended that the height of the tuyeres above the sand bottom should be governed by the class of castings produced and the facilities afforded for handling the melted iron. In a foundry producing light castings, where the iron is handled quickly, lower tuyeres can be used than where heavier castings are produced. After the cupola is charged, at least 30 minutes should elapse before turning on the blast. This gives the charges a chance to become heated so that the cupola starts melting hot iron and will continue to do so during the heat. Mr. Palmer stated that each cupola has its individual peculiarities and is a law unto itself.

The discussion of the papers on "Cupola Practice" was spirited and extended. In answer to a question regarding the cause of a varying melting ratio, Mr. Palmer stated that this ratio depends on the size of the cupola, the coke used, the kind of metal melted and numerous other factors. The bed charge should be constant regardless of the amount of iron charged. It is better to have the bed too high than too low; to some extent the proper height of the bed may be determined by the time required to obtain the first iron, which should be from 10 to 12 minutes.

In answer to a question regarding the effect of atmospheric conditions on cupola operations, Mr. Palmer stated that he was able to melt faster in wet weather than in dry. He did not believe this was due to tighter belts on the blower during damp weather because the same phenomenon was observed with direct connected, motor driven blowers.

Two Rows of Tuyeres.

Mr. Palmer said he used two rows of tuyeres in his cupola, but advised plugging the upper row, if possible, when melting a relatively small amount of metal. This opinion was confirmed by other speakers. Mr. Palmer stated that his 48-inch cupola requires more limestone proportionately than the 72-inch furnace. Mr. Brown asked if the first ton of iron from the cupola was good enough for high grade castings. He said that in his experience in making textile machinery it had been found advisable to pour the first two or three tons of a heat into pigs. The advisability of this practice was questioned by other speakers, although Mr. Palmer stated that it might be advisable to draw off and pig the first 400 or 500 pounds.

Dr. Moldenke stated that the most important factor in cupola practice is to get the iron started at the right time in from eight to ten minutes after turning on the blast. In order to do this, it is necessary to have the bed charge properly proportioned. He condemned the practice of placing an extra heavy charge of iron on the bed charge of coke and strongly recommended light, evenly distributed charges throughout, decreasing the amount of coke gradually toward the end of the heat. Only the six inches of coke on the top of the bed does any work in melting iron and in order to get the greatest efficiency, the coke charges must be so adjusted that the iron will be melted at the hottest point in the cupola.

Briquetting Metal Borings.

An exhaustive paper on "The Briquetting of Metal Borings" was presented by Dr. Richard Moldenke. This paper described a process developed in Germany for compressing borings and turnings by the use of pressure alone without binders. Cylindrical briquettes, about six inches in diameter and eight inches long, are made. The briquettes are formed in a hydraulic press of special design, provided with intensifiers, which increase the pump pressure of 2,500 pounds per square inch to a final pressure of 35,000 pounds per square inch. Usually, the briquettes are compressed twice—first to a low pressure and finally to 35,000 pounds. Sufficient time is allowed in the process to permit all the air to escape from the briquette. This is a very important feature, since if the briquettes are made rapidly and contain air they will explode when heated to high temperatures. There are ten plants manufacturing these briquettes in Europe; each one cost about $35,000 to erect and over $200,000 was spent in perfecting the process. The plants are provided with receiving bins, which keep the chips received from various manufacturers separate, so that each shop gets back its own scrap in the form of briquettes. The briquettes are made so dense that they may be heated and drop-forged without melting. When using briquettes alone in a cupola, the melting loss is about eight per cent, but the best practice is to charge only five to 15 per cent of the metal in this form. Under these conditions the melting loss is lowered to 3½ per cent. There are some drawbacks in using briquetted borings. The silicon in the castings is lowered more than usual; the total carbon decreases and the sulphur increases. In spite of these facts, the briquettes are sold in Germany at pig iron prices. The cost of manufacture, excluding royalties, is about 60 cents per ton.

Charging Cupolas.

"Mechanical Charging of Cupolas" was the subject of a paper by G. R. Brandon, Harvey, Ill. It described the various types of charging machines in modern foundries and pointed out the conditions under which they are used most efficiently. The paper also described correct methods for laying out the stock yard and for handling the stock from the yard to the cupola.

Heated Foundry Mixers.

In a paper on "Progress in Heated Foundry Mixers", J. B. Nau, New York, discussed the use of mixers as intermediary receptacles placed between the blast furnace and the foundry, into which iron from the blast furnace could be poured and kept liquid for any desired length of time. While in the mixer, the quality of iron can be corrected by suitable additions of either liquid or solid pig iron, or by additions of wrought iron scrap, should it be desired to obtain a metal with lower carbon content. From this mixer, the metal is withdrawn whenever needed in the foundry. Its use is more especially recommended in pipe foundries.

The paper on "Titanium in Iron", presented by Chas. V. Slocum, is given in abstract as follows:

The manufacture of titanium in the form of an alloy was undertaken on a commercial scale in 1907 and the results in the early tests were considered for a time the basis upon which it will be necessary to place this material on the market. After repeated trial and experiments, different results were obtained and it became necessary to modify these original ideas in accordance with these developments. Two-tenths of one per cent of this alloy, which contains only 0.02 per cent of metallic titanium, is frequently sufficient for

A View of the Operating Exhibits in Mechanical Hall

cleaning iron of impurities remaining in the metal after the ordinary fluorspar has accomplished all that can be done in this direction. The effect of small fractions of a percentage of titanium in iron is to increase the fluidity and at the same time to make the metal more homogeneous, so that the castings are closer grained and are free from pin holes, gas bubbles and blow-holes. The shrinkage in treated iron is less than in an untreated casting. It has also been found that the metal treated with titanium remains hot longer than untreated, thereby allowing more time for the gases to escape from the iron in the mold. When the titanium alloy is added in the cupola, it does not affect the lining unless large percentages are used and when these large percentages are necessary, it is advisable to add the alloy in the ladle, taking the necessary precautions to prevent the alloy from coming into contact with the slag. In a recent trial of titanium alloy in a cupola with a mixture of burnt iron stove plate, etc., in a large foundry in the Pittsburg district, one-half of one per cent of the alloy was used with one-half of one per cent of ferro-manganese of the usual 80 per cent grade. This only demonstrated the fact that the poorest mixture may be brought to good normal iron by the use of this alloy. The average breaking strain of the test bars cast from this heat was 3,100 pounds per square inch, with an average deflection of 0.146 inch.

Handling Defective Castings.

An interesting paper, entitled "Defective Castings and How to Handle Them", read by John M. Perkins, is presented, briefly, herewith:

This subject is of vital importance to every foundry proprietor and all engaged in the manufacture of castings. The problem of reducing the percentage of defective castings should first be considered in the draughting room, as there are many more details, seemingly of no importance to the engineer, which should be considered from the foundryman's viewpoint. The patternmaker should consult with the foundryman before making his patterns and after the pattern has been completed and a small casting has been made and checked, it is up to the foundry to consider the question of production. The foundryman should consult with the coremaker, the molder and the cleaning room foreman as to the best method of procedure.

If a foundry is operated on a piecework basis and each molder guarantees his work, the question of defective castings is much simplified. In other shops in which there is a strong opposition to piecework, a given day's work is established and a monthly bonus is paid for low percentages of defective work. In one of the largest foundries in the country a bonus of $15 per month is paid to molders whose work shows less than two per cent loss; $12 for less than three per cent loss; $10 for less than four per cent loss; $7.50 for less than six per cent loss. The foremen in the shop participate in the bonus system, their bonus being taken from an average of all the molders' percentages. In many shops there are *trouble men*, who look over all defective castings and ferret out causes for defects. These men are indispensable, especially in a large foundry, where small defects are often permitted to continue, sometimes indefinitely, without being remedied. There are five factors essential to a lower percentage of bad castings, as follows:

First.—A sand from which good castings can be made continuously.

Second.—The combined ideas of all interested in the making of a casting, so as to obtain the best equipment for its production.

Third.—A substantial incentive offered for good work.

Fourth.—Having made a good casting, to insure its shipment in as good condition as when it left the foundry.

Fifth.—A clean, well-equipped shop.

Molding Machine Practice.

The Tuesday afternoon session closed with the presentation of two papers on molding machine practice, by E. H. Mumford and John Alexander. Mr. Mumford's paper is published elsewhere in this issue.

John Alexander's paper on "Machine versus Hand-Molding" pointed out the many advantages of the former method over the latter. Some interesting notes on the history of molding machine practice were contained in the paper. In 1860, some foundrymen were using squeezers, and in 1864, machines had been invented for molding gear wheels. In 1869, the first patent was granted for jarring machines.

The Wednesday morning session opened with an exhaustive paper on "Permanent Molds", by Edgar A. Custer. The author stated that molding in sand and in permanent molds are as far apart as the poles, and then described fully the characteristics of castings made by the latter method. The permanent mold is possible because the iron does not chill until some time after it sets and is always removed from the mold while hot and before chilling commences. To use permanent molds, continuous melting is necessary, and the paper described the process of continuous melting in cupolas producing from one to five tons per hour. The permanent mold is not a cure-all for all foundry ills. Manganese and sulphur should be avoided in the mixture, since high manganese makes the castings hard and brittle and sulphur has the same effect. Between two and three per cent, the amount of silicon has no effect on the hardness of the iron, since it is not given time to cause the precipitation of graphitic carbon. An ideal iron for permanent molds would analyze as follows:

	Per cent.
Silicon	2.25
Sulphur	0.04 or less
Manganese	0.04 or less
Total carbon	4.00

The discussion of this paper brought out the fact that thin or thick castings are taken out of the mold in practically the same time, but in the case of thick castings only the outer shell has hardened. When permanent mold castings are plunged into cold water at a yellow heat, the combined carbon is raised and the grain made finer, but the iron is not whitened. Plunging in oil merely closes the grain. High sulphur or manganese generally makes it hard to prevent blow-holes and shot are produced in the castings by the splashing due to careless pouring.

A paper entitled "The Foundry at Close Range", by B. D. Fuller, is published elsewhere in this issue.

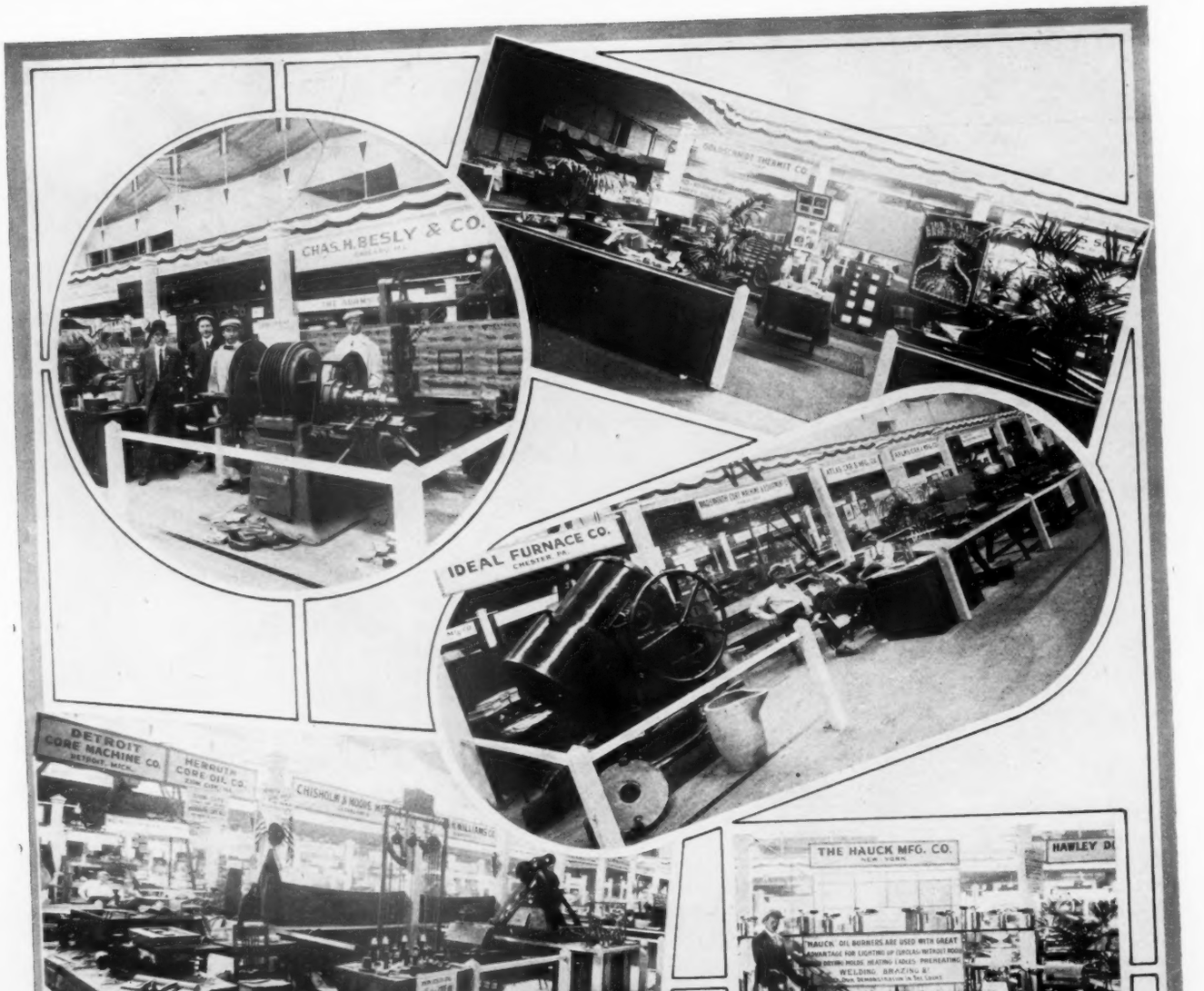
Archie M. Loudon read a paper on "Coremaking and Core Machines," describing particularly machines for making large cores. An abstract of a paper on "Core Room Practice", presented by F. A. Coleman, follows:

This paper is written from the engineer's point of view and deals with the tools and equipment for the use of the coremaker. The equipment necessary for coremaking consists of devices for preparing the core sands, making the cores, baking the cores and space for the storage of sand, fuel and the cores. The essential feature of preparing a core mixture is to rub the binder all over each particle of the core sand to thoroughly incorporate the binder and sand into a homogeneous mass. The mere sifting and riddling of the ingredients is not real mixing, nor is it efficient or economical as to binder. The use of old sand is a great economy and every foundry should use as much of it as possible. The jar-ramming molding machine had not been long in use before the keen-eyed coremaker saw its possibilities and now there are several forms of machines on the market of the jar-ramming type. The roll-over molding machine is also being adapted to the making of different cores, as well as stripping plate and drop pattern molding machines.

Core Ovens.

Core ovens should be designed for two classes of work, namely, for baking bench or small cores and floor or large cores. Ovens for small cores are divided into two classes, portable and stationary. The continuous core oven handles only small cores and while it has a limited field, it should be valuable under the special conditions permitting its use. For large cores the car oven is generally used. It consists of a brick chamber containing one or more tracks and a heating system. The tracks are always important in every car oven and as the loads increase, the greater is the need for good tracks.

Where the core department can be laid out so as to locate the ovens in a room apart from the coremakers, better results are obtained, both as to quantity and quality of output. The arrangement of the benches, ovens and racks for green sand cores depends somewhat upon the system of distributing the sand and of handling the green cores from the bench to the ovens. The core room should be so arranged that the finished cores can be unloaded under the main bay cranes, either by running the cars out on the main floor in the foundry, or by swinging the



Chas. H. Besly & Co., Chicago

Goldschmidt Thermit Co., New York

Ideal Furnace Co., Chester, Pa.; Wadsworth Core Machine & Equipment Co., Akron, O.; Atlas Car & Mfg. Co., Cleveland

Detroit Core Machine Co., Detroit; Herruth Core Oil Co., Zion City, Ill.; Chisholm & Moore Mfg. Co., Cleveland, and G. H. Williams Co., Cleveland

Hauck Mfg. Co., New York.

Adams Co., Dubuque, Ia.

cores from the core car by jib cranes onto the main foundry floor.

S. H. Stupakoff read a paper on "Recent Developments in Pyrometry", which discussed the selection and use of pyrometers for foundry service. The selection of the proper protecting tubes is one of the most important factors in applied pyrometry. For temperatures up to 2,500 degrees, quartz-protected pyrometers are useful since quartz tubes can be plunged into cold water at this temperature without cracking. Pyrometers based on the thermo-electric principle are also very useful.

The recovery of core sand in a sand-washing machine, built by the Osborn Mfg. Co., Cleveland, was discussed in a paper entitled "Waste Sands of the Foundry", read by S. A. Capron, and published elsewhere in this issue.

Wednesday Afternoon.

The Wednesday afternoon session was devoted to a discussion of steel foundry practice and opened with two excellent papers on open-hearth practice, by Walter MacGregor and R. A. Bull. Mr. MacGregor took up in detail the important points to be observed in manufacturing quantities of steel castings with the use of the small open-hearth. Mr. Bull described exhaustively the operation of modern, oil-burning, open-hearth furnaces.

The discussion of these two papers was extensive and a number of important points were brought out. The suggestion was made that thermit be used at the end of the heat to warm up the residue of the bath and add silicon, but Mr. Bull stated that although the thermit would increase the silicon it is not possible to avoid other deteriorating changes in the composition of the last few hundred pounds of metal poured. This is caused by the slag in the ladle absorbing the manganese and silicon from the steel and disturbing its chemical composition. A thin slag under two inches thick, apparently does little harm, but slags between two and six inches thick, which are usually found in practice, have a very bad effect. In order to overcome this difficulty and get rid of the slag an Illinois steel foundry is experimenting with the use of carbo, a form of crude carbon obtained from petroleum. The carbo is introduced in the ladle in the ratio of about 20 pounds to 25 tons of steel and causes the slag to boil over the edge. It also raises the carbon in the steel from one to two points. In making small castings by the open-hearth process, the use of small heats was advocated in order to prevent the large loss due to the changing composition of the metal in the ladle.

Prof. Bradley Stoughton read a paper on "The Annealing and Manufacture of Converter Steel Castings". He pointed out the advantages and disadvantages and purposes of annealing and stated that the microscope and pyrometer are useful in annealing work, the former giving the nature of the results achieved and the latter telling the proper temperature. Slow cooling produces thick crystals of ferrite and cementite and to avoid this the steel should be cooled rapidly through its critical range of temperature by an air blast. The author recommended the use of Seger cones for determining the temperatures attained in various parts of the annealing furnace. An ordinary horseshoe magnet is a valuable adjunct in annealing steel castings because, with 0.50 per cent carbon or less, castings lose the power of attracting a magnet when they reach a temperature of 1,550 degrees Fahr.

Converter Steel Castings.

In converter practice silicon in steel causes waste in three ways: It increases the slag produced, which increases the amount of metal lost in the slag; it increases the length of the blow, particularly during the interval before the appearance of the carbon flame; and finally all the silicon introduced with the pig iron is burned and this represents a loss of weight. Converters should be worked rapidly at the rate of at least three blows per hour and not less than 12 blows in 3¾ hours. A converter foundry is almost foredoomed to failure if it attempts to compete in the open market with the open-hearth process in castings averaging over 100 pounds each. The converter cannot hope to make large castings at as low a price as the open-hearth furnace, but it can make small castings at a cheaper price and can get better prices on account of greater freedom from blow-holes and better appearance and detail.

A paper on "Titanium in Steel Castings", read by Charles V. Slocum, discussed the effect of the introduction of titanium into cast steel.

Electric Induction Furnace.

C. H. Vom Baur read a paper on "The Practicability of the Induction Furnace for Making Steel Castings". This paper was accompanied by numerous lantern slides and described in detail the induction type of electric furnace, which has been used in Europe for ten years. When charged with cold metal, this furnace produces castings at a cost of $21.75 per ton, with electricity at 0.6c per kilowatt hour. When hot metal is charged, the steel at the spout is produced in a five-ton furnace for $19 per ton. Mr. Vom Bauer discussed in detail the characteristics, chemical composition and physical properties of electric steel compared with converter or open-hearth steel.

Dr. P. Heroult presented a brief paper on "Heroult Electric Furnaces for Steel Castings" which, in abstract, is as follows:

The main feature of what is called strong iron is the low content of sulphur. The removal of sulphur is one of the easiest and most effective operations that can be performed in the electric furnace. It consists simply in pouring into the furnace a charge of molten pig iron, if possible, direct from the blast furnace, if not, from a cupola or other melting apparatus, then heating the metal under a basic slag, which does not have to be scraped or removed except when it is teemed into a ladle with the metal ready for pouring. The contents in carbon, silicon, manganese and phosphorus are not affected by this operation unless this be desired. Bessemer iron can be changed into strong iron, charcoal iron, car wheel iron, or so-called cold-blast charcoal iron, for a cost of about $1 per ton.

It seems probable, that on account of the high grade of material so cheaply produced, most of the iron castings of the future will be made of this improved quality. This new improved product will help to give new life to the iron foundry trade, and will enable it to compete with the steel casting industry.

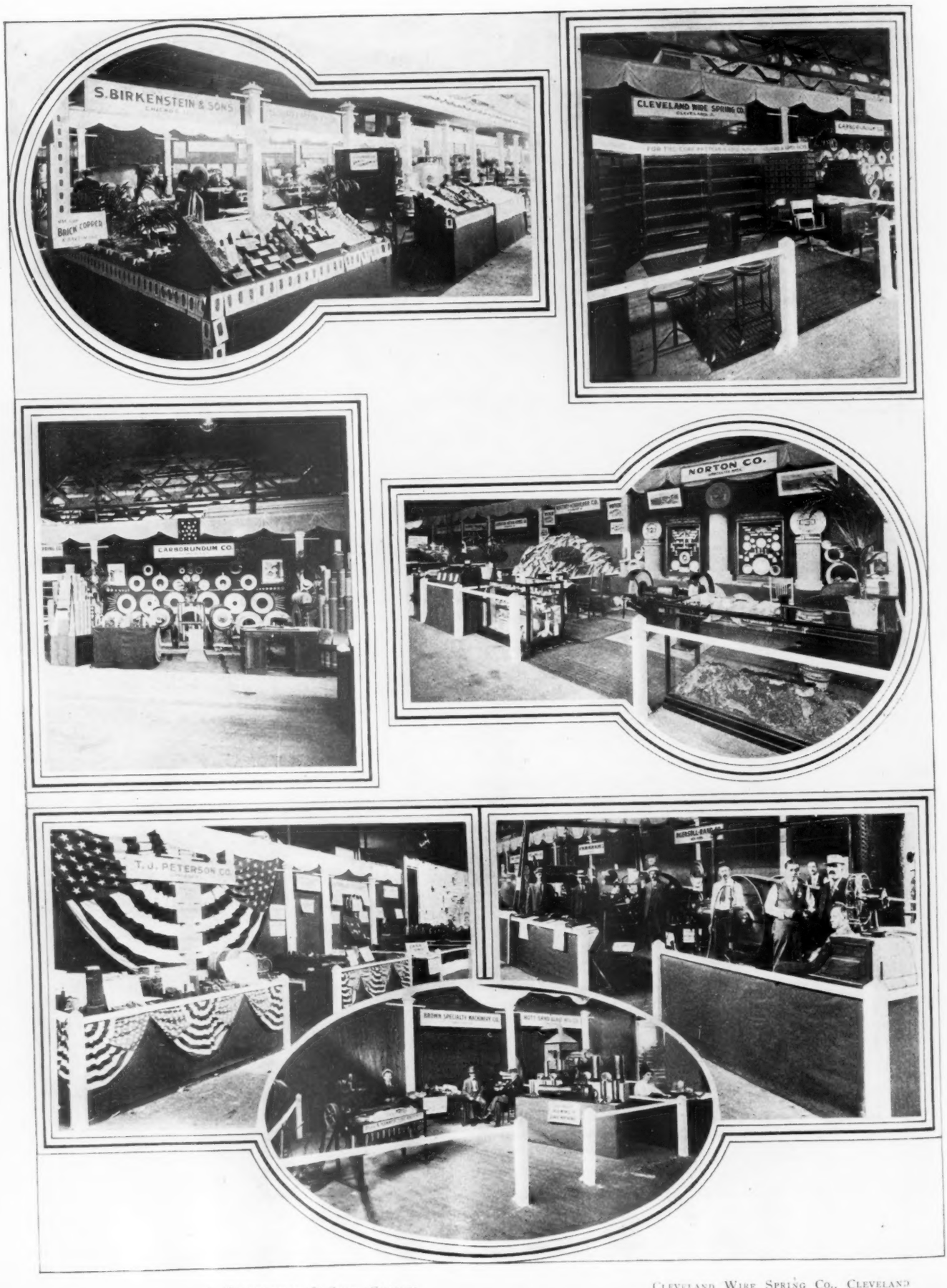
The session Wednesday concluded with a scholarly paper on "The Microscopic Structure of Iron and Steel", by Prof. Wm. Campbell. This paper gave laboratory directions for the microscopic study of iron and steel and was accompanied by numerous lantern slides, showing the structure of steel rails, bars and gray iron and steel castings.

Thursday Morning Session.

A paper presented by G. L. Norris described the advantages of vanadium alloys in steel castings, particularly in parts subject to severe wear. Mr. Norris stated that vanadium rolling mill pinions have worn two-and-a-half times as long as ordinary carbon steel pinions.

"Foundry Construction", by Geo. K. Hooper, will be published in full in an early issue of THE FOUNDRY.
This paper was read by title.

Brent Wiley, in a paper on "Electric Motor Drive for Foundries", discussed the advantages of this system over other methods of transmitting and distributing power. The average plant load is one-third the total capacity of the motors installed, considering only the hoist motors on cranes. About 35 kilowatt hours per ton of steel castings and 45 per ton of iron castings is the amount of electrical power required in an average, well-equipped plant. The



S. Birkenstein & Sons, Chicago

Cleveland Wire Spring Co., Cleveland

Carborundum Co., Niagara Falls, N. Y.

Orenstein-Arthur Koppel Co., Pittsburg; Whitney-Kemmerer Coke Co., Pittsburg; Norton Co., Worcester, Mass.

T. J. Peterson Co., Chicago; Stanley Doggett Co., New York

Ingersoll-Rand Co., New York

Brown Specialty Machinery Co., Chicago; Mott Sand Blast Mfg. Co., Chicago

paper also took up points regarding the load factor, generator equipment and the relative merits of alternating and direct current distribution.

Rotary Cupola Blowers.

R. H. Rice described, and illustrated with lantern slides, a new type of centrifugal air compressor, suitable for use as a cupola blower. This type of machine delivers an extremely steady flow of air. It is said to have a high efficiency, extending over a long period of time and to require a minimum of power.

A paper on "The Application of Lifting Magnets for Foundry Work", which was read by H. F. Stratton, is published elsewhere in this issue.

"Patternmaking and Patternmaking Equipment" was the subject of a voluminous and comprehensive paper presented by W. S. Giele, of which the following is a summary:

The patternmaking for various classes of castings is discussed at length and includes patterns for boiler and furnace castings, stove plate, automobile parts, parts for textile and paper mill machinery, machine tool castings, cylinders, flywheels, chain sprockets, cast iron pipe, valves, pipe fittings, cast iron sanitary ware, open feed water heaters, steam and oil separators, cast iron car wheels, etc. Interesting data are also presented on the methods of mounting patterns for molding machines. It is pointed out that the use of the vibrator to assist in drawing the pattern is quite general, as it does not appreciably enlarge the mold, but merely overcomes the friction of the pattern against the sand and while the pattern without any draft can be drawn perfectly, care should be taken that there is no back draft. Pattern shop equipment is also discussed and numerous labor-saving devices are described. In conclusion, it is pointed out that in the pattern shop the capable patternmaker can work much faster with his head than with his hands and his skill and manual dexterity is applied to the best advantage when devoted to the intelligent handling of mechanical equipment especially adapted to patternmaking.

Fuel Oil Air Furnaces.

"The Equipment of Air Furnaces Using Oil as Fuel" was the subject of a paper presented by N. W. Best, which is published elsewhere in this issue.

Final Session.

An exhaustive paper on "Gas Cavities, Shot and Chilled Iron in Iron Castings", by Thos. D. West, opened the concluding session Friday morning. It deals with the causes and remedies of defects in castings due to gas formations, chilled iron embedded in the metal and the occurrence of shot. The paper is the result of a large amount of research and investigation. Shot in castings may be caused by the coke, by the compressive action of the molten metal, by splashing iron falling from the ladle against flat surfaces or produced by careless pouring and also by improper and unskillful molding. Machine-molded castings, on account of the greater uniformity of conditions under which they are produced are less liable to defects of this character.

"Titanium in Malleable" was the subject of a paper by C. H. Gale. A series of experiments were made to determine the effect of the addition of titanium alloys to malleable castings when added to the metal in the ladle and also when mixed with the bath in the open-hearth. Test bars with no titanium showed a white fracture, 47,000 pounds tensile strength, 1,180 pounds transverse strength and six per cent elongation; bars containing 0.125 per cent titanium added to the ladle had a mottled fracture, 44,000 pounds tensile strength and 1,300 pounds transverse strength, and bars containing 0.25 per cent, added to the ladle, showed a gray fracture, 43,000 pounds tensile strength and 1,900 pounds transverse strength. The tests of bars containing titanium which had been added to the bath, gave better results. The experiments indicate that titanium makes the metal more ductile. Mr. Alexander, in discussing the paper, gave detailed results of some tests conducted under his supervision and concluded that an addition of between four and six per cent titanium to malleable iron would be of benefit, particularly when pouring large castings.

Determining Constituents of Foundry Coke.

The following "Proposed Standard for Determining the Constituents of Foundry Coke" was presented:

Each carload of coke shall be considered as a unit. While the car is being unloaded, full length pieces of coke shall be taken at about equal intervals and a sample approximately the size of an egg taken from each end and also from the middle of each piece, until 25 to 40 pounds are obtained. Should it be necessary to sample from a stock pile, 25 to 30 pounds of sample, obtained as directed, shall be taken for each 50 tons in the pile, care being used to get the piece from different places which will give a fair average sample.

Preparing the Sample.

Crush the sample between hardened surfaces, preferably of manganese or chrome steel, until all the material passes through a ½ inch mesh sieve. Quarter this; reserve one portion for moisture determination and crush the other portion until it will pass through a ¼ inch mesh sieve, and again quarter down until about two pounds remain. Crush this until it will pass a No. 20 mesh sieve, and quarter down to about 20 grams. Grind this until it all passes through a No. 100 mesh sieve.

Moisture.

Dry one kilogram of ½ inch mesh sample to constant weight at 104 to 107 degrees Cent. The loss in weight shall be calculated to per cent moisture. Moisture shall be determined on the ground sample by getting the loss in weight when one gram sample is heated in an open platinum crucible of about 20 c.c. capacity for one hour at 104 to 107 degrees Cent. The moisture on the ground sample shall be used to calculate the other results obtained from the ground sample to percentages in the coarse, undried sample.

Volatile Matter.

Cover the crucible containing the dried sample with another crucible (either platinum or porcelain) of such a size that it will fit closely to the sides of the outer crucible, and its bottom will rest ⅛ to ¼ inch above the bottom of the outer crucible.

Ignite 3½ minutes with the Bunsen burner and 3½ minutes with the blast lamp. Let cool, remove the inner crucible and reweigh the outer crucible with contents. The loss of weight is volatile matter.

Ash and Fixed Carbon.

Ignite the sample upon which the volatile matter was determined until all the carbon is burned, having the crucible open and inclined. The ash should be tested for unburned carbon by moistening it with alcohol, which will show black any carbon remaining. After all carbon is burned, the weight of the crucible and ash minus the weight of the crucible, gives the amount of ash in the sample.

The amount of fixed carbon is obtained by subtracting the weight of the crucible and ash from the weight of the crucible and residue from the volatile matter determinations.

Sulphur.

A soft steel or nickel crucible of about 40 c.c. capacity, the lid being perforated with a small hole for the introduction of the igniting wire, is used.

Any arrangement suitable for holding the crucible firmly in place and out of contact with the beaker during the peroxide combustion will serve as the crucible stand.

Determination.

To the dry crucible add first 12 grams of sodium peroxide and 0.5 grams of powdered potassium chlorate, then exactly 0.7 grams of coke (80 mesh) and mix thoroughly by means of a small spatula. Place the covered crucible on its stand in a 20-ounce beaker containing enough water to immerse the lower half of the crucible.

Ignite the crucible contents by thrusting in, for a moment, a red hot wire through the lid hole. Wait two minutes or longer for the mass to cool somewhat, remove the stand and tip over the crucible on its side in the water. After the fusion dissolves, rinse and remove the crucible.

Acidify the solution with hydrochloric acid, then add ammonia in slight excess, filter and wash. To the filtrate add a drop of methyl orange, then hydrochloric acid from a graduated pipette or burette until 0.5 c.c. in excess. Bring to boiling, add drop wise about 10 c.c. of barium chloride solution, continue boiling at least 15 minutes longer, and allow it to stand in a warm place for not less than two hours, filter, wash until the silver nitrate test shows no chlorides, ignite and weigh as $BaSO_4$.

Grams $BaSO_4 \times 19.6 =$ per cent sulphur.

Phosphorus.

Ignite 5 grams of coke in a platinum dish or large platinum crucible until all the carbon is burned off, then add 10 c.c. hydrochloric acid (1-1) and 20 c.c. hydrofluoric acid and evaporate to dryness and ignite at a dull red heat. Fuse the residue with about 1½ grams of sodium carbonate and 2 grams

ROCKWELL FURNACE CO., NEW YORK

TABOR MFG. CO., PHILADELPHIA

HERMAN PNEUMATIC MACHINE CO., ZELIENOPLE, PA.

ARCADE MFG. CO., FREEPORT, ILL.

J. S. MCCORMICK CO., PITTSBURG

W. W. SLY MFG. CO., CLEVELAND

of potassium nitrate. Cool, place the dish in a beaker of water and boil. Clean and remove the dish. Acidify the solution with hydrochloric acid, precipitate with ammonia, boil, filter and wash with hot water. Wash the filter with warm dilute nitric acid to dissolve the precipitate. Should it not dissolve, wash with warm dilute hydrochloric acid until dissolved. In the latter case it will be necessary to evaporate to about 5 c.c., add 30 c.c. nitric acid (1.20 sp. gr.), again evaporate to about 5 c.c., and add 30 c.c. nitric acid (1.20 sp. gr.). After heating the solution to between 70 and 90 degrees Cent., add 50 c.c. of molybdate solution. Agitate the solution a few minutes, then filter, and wash five times with a 3 per cent nitric acid solution, and five times with a 0.1 per cent potassium nitrate solution. Transfer the precipitate and filter to the flask in which the precipitate was made. Add 30 c.c. water, then $Na\ OH$ (N_5) from a burette until in excess, keeping the solution agitated. When the yellow precipitate is all dissolved add 0.1 c.c. of phenolphthalein solution as indicator, and then titrate with $H_2\ SO_4$ (N-5).

c.c. (N-5) $NaOH$ — c.c. (N-5) H_2SO_4 × 0.0054 — per cent phosphorus.

To make the molybdate solution, add 100 grams molybdic acid to 250 c.c. water, and to this add 150 c.c. ammonia. Stir until all is dissolved and add 65 c.c. nitric acid (1.42 sp. gr.). Make another solution by adding 400 c.c. concentrated nitric acid to 1,100 c.c. water, and when the solutions are cool, pour the first slowly into the second with constant stirring and add a couple of drops of ammonium phosphate.

The remaining papers, "Phosphorus", by H. E. Field; "The Foundry Foremen's Educational Movement", by D. C. Wilson, and "The Pattern Shop Apprentice", by Jabez Nall, were read by title.

Election of Officers.

Major Joseph T. Speer was unanimously re-elected president of the American Foundrymen's Association for the ensuing year. This is a splendid tribute to Major Speer's efficient and capable services, since it is contrary to the custom of the association to re-elect the retiring president. As in previous years, Dr. Richard Moldenke was re-elected secretary and treasurer. The following district vice presidents were elected: First district—F. B. Farnsworth, New Haven, Conn.; second district—W. D. Miles, Buffalo, N. Y.; third district—Walter Wood, Philadelphia; fourth district—A. E. Howell, Nashville; fifth district—R. A. Bull, Granite City, Ill.; sixth district—T. W. Sheriffs, Milwaukee; seventh district—D. R. Lombard, Augusta, Ga.; eighth district—S. B. Chadsey, Toronto.

Buffalo in 1912.

Buffalo was chosen as the place for holding the 1912 convention. Votes of thanks were extended to Dr. Richard Moldenke for extraordinary services, to the committee on papers and to the plant visitation committee. A motion was passed to appoint a committee to suggest a uniform report form for chemical analyses. A brief address by J. S. Seaman, expressing the association's appreciation of Major Speer's administration, concluded the meeting.

Associated Foundry Foremen.

At the annual meeting of the Associated Foundry Foremen, Robert B. Thomson, of the Buffalo-Pitts Co., Buffalo, was re-elected president, Hugh McPhee was re-elected secretary, and W. H. Woods, president of the Pittsburg Foundry Foremen's Association was elected first vice president.

Entertainment Features.

Wednesday afternoon, the ladies at the convention were given an automobile ride, covering the principal points of interest in Pittsburg. Dinner was served at the Country Club. Thursday afternoon was devoted to an excursion by special train to the plants of the Westinghouse Air Brake Co., the Mesta Machine Co. and the Homestead Steel Works. In the evening, the Foundry & Machine Exhibition Co. entertained the members of all the associations and their guests with an elaborate vaudeville program in the music hall of the Western Pennsylvania Exposition Society. Friday afternoon, the members of the various associations and their guests attended the ball game between the Pittsburg and Cincinnati teams.

A subscription dinner, the first held in connection with the American Foundrymen's Association meetings, was served at the Fort Pitt hotel, Friday evening, May 26, to about 250 members of the three associations. President J. T. Speer, of the American Foundrymen's Association, introduced H. E. Field, Pittsburg, chairman of the convention committee, who presided as toastmaster.

The three principal speakers of the evening were Dr. John A. Brashear and Congressmen James Francis Burke and A. J. Barchfeld, all of Pittsburg. Congressman Barchfeld spoke at length on the progress of work on the Panama canal, illustrating his address with lantern slides. Mr. Burke aroused enthusiasm by predicting "that before the end of six months this country will have entered on an era of the greatest prosperity in its history", giving the reason for his faith in three events, just past or impending—the settlement of the war cloud with Mexico, the enactment of reciprocity with Canada, which he said would soon be a fact, and the handing down of the Standard Oil decision by the supreme court. He referred to the latter as having removed the shackles from the business world and furnishing an incentive for a healthy commercial and industrial activity.

Short talks were made by J. S. Seaman, president of the Seaman-Sleeth Co., Pittsburg, and the oldest living ex-president of the American Foundrymen's Association; George R. Raynor, president of the Foundry & Machine Exhibition Co.; Richard Moldenke, Watchung, N. J., secretary of the American Foundrymen's Association; W. M. Corse, Buffalo, secretary and treasurer of the American Brass Founders' Association; Robert B. Thomson, Buffalo, president of the Associated Foundry Foremen; W. H. McFadden, Pittsburg, and Alfred E. Howell, Nashville, Tenn., vice president of the American Foundrymen's Association.

Foundry Foremen's Banquet.

An enjoyable feature of convention week was the informal dinner given to the visiting members of the Associated Foundry Foremen, by the Pittsburg Foundry Foremen's Association, at the Fort Pitt hotel, Wednesday evening, May 24. The large banquet hall of the hotel, known as the English room, was the scene of the festivities. William H. Wood, president of the local association, delivered an address of welcome, and introduced Prof. C. B. Connelly, dean of the Carnegie Technical School, as toastmaster. The speakers included Robert B. Thomson, president of the Associated Foundry Foremen; Hugh McPhee, secretary of the same organization; Major Joseph T. Speer, of the Pittsburg Valve Foundry & Construction Co., president of the American Foundrymen's Association; Frank W. Treacy, of the chamber of commerce, Buffalo; Dr. Richard Moldenke, secretary of the American Foundrymen's Association; Dr. Arthur A. Hamerschlag, director of the Carnegie Technical Schools, and Rabbi J. Leonard Levi.

Robert B. Thomson congratulated the Pittsburg Foundry Foremen's Association on the manner in which it had built up its organization since December, 1910, to the present financial and numerical strength as evidenced by the splendid hosptality which it extended. He stated that the national organization of foremen was growing slowly, and urged regular attendance at the meetings of the local associations, as the lack of interest shown by meager attendance was very discouraging. Hugh McPhee spoke of the educational value of the convention exhibit to foundry foremen, and read a letter from the chamber of commerce, Buffalo, inviting the allied foundrymen's associa-

Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Ohio Sand Co., Conneaut, O.; Interstate Sand Co., Zanesville, O.; Joseph Dixon Crucible Co., Jersey City, N. J.

Hawley Down Draft Furnace Co., Chicago

Buckeye Products Co., Cincinnati

Graceton Coke Co., Graceton, Pa.

tions to hold the next convention in that city.

Major Joseph T. Speer talked interestingly of his experiences in the foundry, and alluded to the improvement in methods that has taken place in recent years. Speaking of the educational advantages of the present day, he said that it had now become difficult to distinguish between the employer and the employe.

Dr. Moldenke spoke of the educational advantages of the convention, and of the work of the American Foundrymen's Association. Dr. Arthur A. Hamerschlag told of the influence technical education is destined to have on the foundry industry, and stated his belief that the old-time methods of educating apprentices must change, that the day of slow, laborious progress through the shops from sweep boy to molder, had passed away, to be supplanted by the superior advantages of the technical school. The bugbear of modern founding, he stated, is the striving for large tonnage instead of high grade work. He advised the admixture of brains and imagination with the work, in order to obtain improved product instead of increased tonnage. "Make smooth and clean castings, free from blowholes or other defects," he said. "Improve the quality and reduce the loss, so that the intrinsic value of the product will be greater, and higher prices can be then obtained."

The theme of Rabbi Leonard Levi was "A Word in Due Time," and proved a most interesting and eloquent address, interspersed with a fund of anecdote on the prevention of strife and discord between labor and capital, and war between nations.

From the Quaker City.

Philadelphia foundrymen traveled to Pittsburg for the convention in a special car and the party consisted of the following: Thos. Devlin, Thomas Devlin Mfg. Co.; Mrs. Caroline M. Begley; John C. Purcell, Baldwin Locomotive Works; Mrs. John C. Purcell; C. Gorman, Maryland Steel Co., Sparrows Point, Md.; John Alexander, Harrison Safety Boiler Works; R. T. Thum, Girard Iron Works; C. S. Grimes and C. H. Burrows, Standard Roller Bearing Co.; J. I. Fasey, Philadelphia Chaplet Co.; Geo. C. Davis; Walter S. Bickley, Penn Steel Casting & Machine Co.; E. W. Word, THE FOUNDRY; Henry Huder and W. E. Ertle, Schaum & Uhlinger; Frank Francis, Chester Steel Casting Co.; Howard Evans and E. M. Taggart, J. W. Paxson Co.; W. I. Grubb and John Wiegner, Light Mfg. Co., Pottstown, Pa.; W. W. Parry, American Pattern Co.; Arthur Smith and A. D. Ineson, Ingersoll-Sargeant Drill Co.

Inspection of Coke Plant.

The Jamison Coal & Coke Co., Pittsburg, on Friday, May 26, entertained a number of visitors and representatives of Rogers, Brown & Co., in attendance at the foundrymen's convention, at two of its mining and coking properties at Greensburg, Pa. The party left Pittsburg on a special car over the Pennsylvania railroad, in charge of W. S. Johnston, general sales agent of the Jamison Coal & Coke Co., and W. G. Ireland. At Greensburg the party was met by a number of automobiles for the trip to the plants. The mines, washers and coke ovens of the Jamison company were inspected and lunch was served at the Crab Tree, Pa., plant, the party returning to Pittsburg in the afternoon. Rogers, Brown & Co. are the representatives of the Jamison Coal & Coke Co., and it was the friends and customers of the latter that were invited by the Jamison company. The trip was made by the following: N. C. Carr, Richmond, Ind.; W. S. Robb, Irvington, N. Y.; A. E. Proulx, Lowell, Mass.; H. P. McKimm, Boston; A. J. O'Conner, Boston; J. Goostray, Boston; Fred H. Eastman, Chelsea, Mass.; James H. Scott, Wilmington, Del.; Neil C. Gibbons, Wilmington, Del.; M. E. Simpson, Minneapolis; E. S. Sweet, Binghamton, N. Y.; George B. Foresman, Williamsport, Pa.; E. W. Anthony, Boston; E. H. Johnson, Trenton, N. J.; M. N. Norton, Troy, N. Y.; J. J. Davison, Watertown, N. Y.; Allen T. Ford, Bridgeport, Conn.; Arthur W. Gibbey, Boston; Charles Herbald, Cleveland; E. C. Bailey, Milford, Mass.; A. D. Ireson, Phillipsburg, N. J.; Arthur Smith, Phillipsburg, N. J.; N. W. Shed, Buffalo; H. B. B. Yergason, Cincinnati; Wm. P. Cheney, Pittsburg; H. S. Philson, Pittsburg; Otto Arlt, New York; R. W. Clark, New York; G. R. Sullivan, Philadelphia; H. C. Thomson, Philadelphia; F. J. Waldo, Buffalo; C. A. Wyatt and F. E. Fitts, Boston.

WILLIAM W. SLY

Death of W. W. Sly

William W. Sly, president of the W. W. Sly Mfg. Co., Cleveland, died in that city May 22, after a protracted illness. Mr. Sly was engaged in the manufacture of foundry equipment for many years, having developed the cinder mill for the recovery of iron, and he also specialized in cleaning room equipment, dust arresters, etc. His acquaintance among foundrymen extended from coast to coast and notwithstanding his age, he traveled extensively in the interest of his concern. Mr. Sly was born in Oakland county, Mich., in 1834, and after teaching school for a number of years, became interested in the manufacture of foundry equipment and established the W. W. Sly Mfg. Co. in Cleveland in 1874, the business having been incorporated in 1903. At the time of his death he was engaged in the development of a sand blast for foundry use. Mr. Sly was a member of the G. A. R. and is survived by his widow, a daughter, and a son, Wilfred C. Sly, secretary of the W. W. Sly Mfg. Co.

The J. W. Paxson Co., Philadelphia, is completing a new plant covering an area of 9,000 square feet, which will be equipped for the manufacture of foundry supplies, including riddles, wire, bristle and split bamboo brushes and brooms, boiler tubes and flue cleaning brushes, foundry bellows, pattern letters and figures. The building is of concrete and steel construction and has a saw-tooth roof. In addition to this plant the company operates shops for the manufacture of foundry equipment, pattern and blacksmith shops, etc.

The E. J. Woodison Co., Detroit, manufacturer of foundry supplies, is sending to the trade several folders, the one entitled "What Makes the Price of Castings" contains an article written by John J. Wilson, superintendent of foundries of the General Motors Co., and another folder is devoted to fire brick for foundry use.

MUMFORD MOLDING MACHINE CO., PLAINFIELD, N. J.
JONATHAN BARTLEY CRUCIBLE CO., TRENTON, N. J.; WESTINGHOUSE ELECTRIC & MFG. CO., PITTSBURG
NATIONAL CORE OIL CO., BUFFALO
GRAF MOLDING DEVICE CO., LOUISVILLE; JAMES JILES CO., PITTSBURG; H. H. FRANKLIN MFG. CO., SYRACUSE, N. Y.
A. BUCH'S SONS CO., ELIZABETHTOWN, PA.
OLIVER MACHINERY CO., GRAND RAPIDS, MICH.
ELECTRIC CONTROLLER & MFG. CO., CLEVELAND

BRASS FOUNDERS' ANNUAL CONVENTION

Report of the proceedings of the meeting of the American Brass Founders' Association at Pittsburg

AT A joint meeting of the allied foundrymen's organizations, held in the Theatorium of the main building of the Western Pennsylvania Exposition Society, at Pittsburg, Tuesday, May 23, the annual convention of the American Brass Founders' Association was formally opened. The address of President N. K. B. Patch, which was presented in his absence by L. W. Olson, reviewed the work of the year, which justified an optimistic view of the future owing to the increase in membership and the flourishing financial condition of the organization. The appointment of an official chemist has proved beneficial to the members of the organization and President Patch stated that any line of research work that might be suggested by the executive committee would be conducted by the chemist for the benefit of the members.

Secretary's Report.

Secretary W. M. Corse reported an increase in the membership from 273 to 287. A monthly bulletin has been added to the list of publications, which contains not only the current news of the activities of the organization, but also abstracts of articles from leading trade and technical journals that might prove of interest and value to the members of the American Brass Founders' Association. Secretary Corse announced that the Standardization Committees would report later in the year, and in conclusion he urged that each member of the association make it a personal matter to secure at least one new member during the next twelve months. The treasurer's report showed a balance of $94.88 and gross expenditures of $1,386.59.

Tuesday Afternoon.

The first paper presented Tuesday afternoon, by J. R. Huber, Buffalo, dealt with "The Analysis of Manganese Bronze." In the discussion that followed, L. W. Olson asked to what extent the analysis of manganese bronze could be taken as an index of its physical characteristics. Mr. Huber replied that it is possible to plot a diagram by means of which the physical properties of the metal can be determined from its chemical composition. W. R. Webster then explained that the physical qualities of manganese bronze vary greatly with different percentages of copper. He added that variations in the content of tin and iron greatly influence the quality of the metal, and that in consequence, the chemical composition can be taken as an index of quality, only when all conditions of making the bronze are the same. The quantity of gases that may be entrapped during solidification also probably affects the physical properties of bronze, although the weakening effect of gases has not yet been determined.

R. T. Roberts desired to know the effect of rapid cooling on manganese bronze. Mr. Corse, in reply, stated he was glad that this question had been asked, as many people have mis-

L. W. Olson, President of the American Brass Founders' Association

taken ideas upon this subject and imagine that a difference of 50 per cent in strength exists between chill and sand castings. A chill casting, he stated, might possess a tensile strength of 80,000 pounds per square inch, and a sand casting from the same alloy would develop 75,000 pounds per square inch. These results were determined in actual practice, although it is the prevailing opinion that a greater difference exists. When making test bars, the advantage of a chill is due to the fact that a much smaller bar can be cast to determine the physical characteristics of the metal in the casting than in the case of a sand cast bar. Therefore, the use of chills in this connection is a desirable economy. The point to be observed in making manganese bronze is to properly feed the casting, and if this is done no difficulty would be experienced in obtaining physical properties that would give high test results.

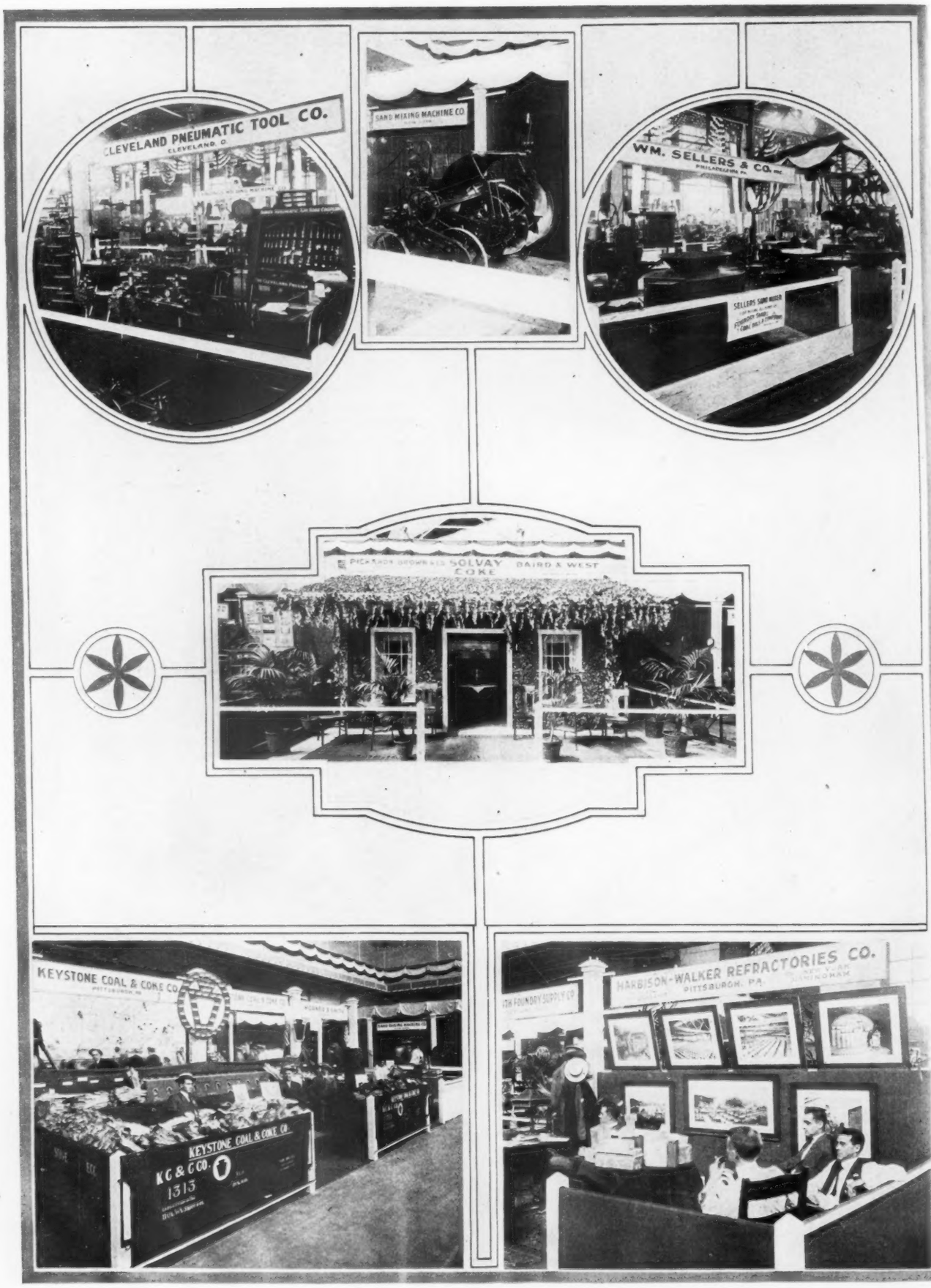
Corrosion.

"The Corrosion of Brass Foundry Products" was the subject of a paper presented by W. Vaughan, Boston. The results of experiments of the corrosion of bronze, composition metal and aluminum bronze in solutions of sodium sulphate, sodium nitrate and common salt were given, and indicated that alloys of copper and tin were preferably used when exposed to solutions of sulphate or nitrate of soda and that aluminum bronze is most resistant to salt water.

An alloy of copper, 70 per cent; zinc, 29 per cent, and tin, 1 per cent, satisfactorily resisted corrosion for a period of nearly seven months and was found to be superior to tubes of pure copper tested at the same time. An alloy of copper, 75 per cent, and nickel 25 per cent, also proved satisfactory. Pure copper had shown itself very susceptible to corrosion, while the alloy, 70-29-1, known as Admiralty metal, was least susceptible. W. R. Webster asked how frequently these results had been checked, and whether they represented individual or a series of observations. The discussion developed the fact that the corrosion of condenser tubes may be caused by electrolysis, the rate of flow and the temperature of the water, and the amount and kind of sediment it contained. Sediment particularly favors corrosion, especially when it takes the form of coal dust.

Efficiencies of Furnaces.

"Efficiencies of Furnaces," by Dr. J. W. Richards, of South Bethlehem, Pa., was the next paper presented and in the absence of Dr. Richards was read by W. R. Webster. The author explained what was meant by efficiency of industrial appliances and cited examples of carelessness in describing the efficiencies of various products. Applied to furnaces, efficiency often means the ratio of fuel to output. In opening the discussion, Mr. Webster asked for information relative to the melting ratios of brass furnaces and stated that in using anthracite coal,



Cleveland Pneumatic Tool Co., Cleveland Sand Mixing Machine Co., New York City Wm. Sellers & Co., Inc., Philadelphia
Solvay Coke Bungalow, Joint Exhibit Made by Pickands, Brown & Co., Chicago, and Baird & West, Detroit
Keystone Coal & Coke Co., Pittsburg; Morner & Smith, Dayton, O. J. D. Smith Foundry Supply Co., Cleveland; Harbison-Walker Refractories Co., Pittsburg

the usual ratio was from 2½ to 3 pounds of metal melted per pound of fuel. The question was then asked how this compared with regular practice, and W. M. Corse stated that with coke the average is 45 pounds of fuel to 100 pounds of metal. H. P. MacKinnon, foreman of the Hersey Mfg. Co.'s foundry, South Boston, Mass., stated that he had melted 900,000 pounds of bronze for light castings for parts of meters, at an average consumption of 3¾ gallons of oil per 100 pounds of metal, in a tilting furnace, and that approximately one-ninth of the metal was in the form of borings. The loss of metal in melting and the subsequent grinding operation was 4.6 per cent. The cost of the oil averaged 18 cents for 4½ gallons. John A. Smith, of the New York Air Brake Co., stated his fuel consumption averaged three gallons of oil per 100 pounds of metal in an open flame furnace.

The annual report of the official chemist of the American Brass Founders' Association, prepared by Carl F. Woods, was read by W. Vaughan. It reviewed the notable accomplishments of the last year from the viewpoint of the brass founder.

Wednesday's Sessions.

At a joint session of the allied organizations held Wednesday morning, W. R. Whitney, Schenectady, N. Y., presented a paper entitled "Alloys," which was not discussed owing to the large number of papers on the program assigned to this meeting. This paper will be published in an early issue of THE FOUNDRY.

"The Pyrometer and the Aluminum Foundry" was discussed by H. W. Gillett, Detroit, on Wednesday afternoon. The author described the thermo-electric pyrometer and explained how it should be cared for and used to the best advantage. Samples of aluminum test bars were exhibited showing the effects of high and low pouring temperatures on the quality of aluminum castings. In the ensuing discussion, the question was asked as to the average number of times that portion of the pyrometer that is immersed in the molten metal could be used. Mr. Gillett, in reply, stated that this part of the pyrometer would last for about 500 immersions.

Bronze Melting Temperatures.

An abstract of an interesting paper by C. P. Karr on "Pouring and Melting Points of High Grade Bronzes," which will be published in full in an early issue of THE FOUNDRY, is presented herewith:

C. P. Karr reported the results of tests made in the foundry of the Nathan Mfg. Co., New York City, to ascertain bronze melting and pouring temperatures. For taking these temperatures a Fery radiation pyrometer was used and as the melting temperatures could not be taken in the foundry satisfactorily, these determinations were made in the laboratories of this concern. Yellow brass was used in the laboratory test, which was made from commercial sheet brass clippings and was found to contain about 68.8 per cent of copper, 0.19 per cent of lead and the balance zinc, with a trace of iron. For this composition the pyrometer indicated a melting point of 1,640 degrees Fahr., but on account of the heavy oxidation of the surface it is believed that this reading may be somewhat too low, particularly as the melting point of brass containing 70 per cent of copper and 30 per cent of zinc has been fixed at 1,742 degrees Fahr. Comparative tests were made to ascertain the difference between the drop in temperature of metal melted in a coal-fired pit furnace and metal melted in a coke-fired tilting furnace. As the composition of the metals compared differed from one another, the average copper constituent had to be about the same and this condition was fulfilled. There were three heats in the coke-fired furnaces with six readings at the foundry floor with an average of 1,832 degrees Fahr., and 32 readings at the pouring bench with an average of 1,780 degrees Fahr., or an average drop of 52 degrees. There were six heats of the metal in the coal-fired furnaces with 15 readings at the furnace floor, with an average of 1,981 degrees Fahr., and 51 readings at the pouring bench with an average of 1,838 degrees Fahr., or an average drop of 143 degrees Fahr. No definite data, however, was obtained from these tests and Mr. Karr concluded that the pyrometer in the brass foundry is only a precautionary means to an end, but not a cure-all. If at the time the observations are undertaken to establish the correct pouring temperature, the pyrometer readings are concurrently taken both as a check and as a record, and the trial is continued consecutively for at least one week to obtain simultaneous readings and concordant results; then the standard pouring temperature may be arrived at and the real value of the pyrometer will be recognized by readings concurrent with the standard thus obtained.

The discussion centered largely on the merits of different types of pyrometers and developed nothing of material benefit to the practical founder.

Economics and Refinements of the Brass Foundry.

A paper was then presented on "Non-Ferrous Economics and Refinements," by E. A. Barnes, which is given briefly herewith:

The buildings for brass foundries should be fireproof and while many designs lend themselves to non-ferrous metal foundry practice, the saw-tooth having its advocate where land is cheap, or the gallery or many-storied building where land is at a premium, my preference is for the gallery construction. The heating of a foundry is of prime importance and I prefer direct radiation derived either from coils of iron pipe built along the wall under the windows or sectional, cast iron radiation similarly placed. Ventilation is another important feature and in saw-tooth and gallery construction buildings the lantern in the roof should be arranged with swinging windows, the natural tendency of the heated gases being to rise and pass out of these openings. This action can be augmented by the use of fans. We have found that the best form of pattern storage racks can be constructed by the use of heavy wire netting mounted on light angle supports. These racks are fireproof and the sand that sticks to the patterns, eventually falls off and sifts through the meshes in the wire. A burglar and fireproof vault, centrally located, should be provided for metal storage. The sand bin should be so arranged that the sand can be unloaded directly from freight cars or wagons into chutes. The crucibles in our plant are stored in a brick vault, which is heated by the waste furnace gases.

Sanitary Arrangements.

The foundry should be equipped with suitable toilet rooms and in our shop we have individual, hygienic wash bowls allotted to each employe, provided with hot and cold water. Each man is also assigned a metallic locker. Shower baths, needle baths, and dressing rooms have also been provided. Suitable meters should be installed in connection with each melting unit so that the exact amount of fuel needed for the melting of the metal can be readily ascertained. In connection with our air compressors, we have arranged special automobile radiator cooling devices, through which the jacket water is circulated when the air compressors are operated. When the air compressors are idle, the water ceases to circulate. In our foundry the brass from the punch press department and the borings and turnings from the machine shop are melted with the gates, sprues and new metal. Much of this material, however, is of a mixed nature and is melted in a special scrap furnace and run into ingots. These ingots are analyzed by the chemist and are further alloyed with pure copper and other new metals in varying proportion and first class metal for all general purposes is thus produced. Aluminum is melted in a tilting furnace arranged with an iron kettle and the loss is only 2½ per cent. We confine our alloys and mixtures to a small number and at present we have no more than 15 to contend with.

In reply to a question by Emil B. Horne as to the most suitable kind of floor for a brass foundry, Mr. Barnes said that concrete was the material used on the gallery floor of his foundry. Mr. Horne stated that there was some objection to concrete on account of explosions when metal is spilled or when heated crucibles are permitted to stand on the floor. Mr. Barnes stated that no such trouble had been

CENTRIFUGAL AIR COMPRESSOR INSTALLED BY THE GENERAL ELECTRIC CO., WHICH FURNISHED THE BLAST FOR THE WHITING CUPOLA

ALBANY SAND & SUPPLY CO., ALBANY, N. Y.

STANDARD LINSEED CO., CLEVELAND

ROGERS, BROWN & CO., CINCINNATI

Left to right, back row—F. E. Fitts Jr., J. R. Morehead, C.A. Wyatt, W. G. Ire ld, H. C. Thomson, F. W. Bauer, O. Arlt, G. M. Butler, S. Hubbard, F. J. Waldo, R. W.Clark, T. A. Wilson, . S. Philson, G. R. Sullivan. Front row, left to right—W. P. Cheney, H. B. B. Yergason andJ. R. Darragh.

PAWLING & HARNISCHFEGER CO., MILWAUKEE

YALE & TOWNE MFG. CO., NEW YORK

Table I.

Crucible Heats.					Results of Physical Tests.					
Heat number.	Metal charged, pounds.	Ingots obtained, pounds.	Loss in pounds.	Loss, per cent.	Heat number.	Ultimate strength, pounds per square inch.	Elongation in two inches, per cent.	Reduction of area, per cent.	Conductivity.	Hardness (Shore).
1	243⅝	216	27⅝	11.34	1	76.850	22.5	21.5	24.10	23.3
2	203	192	11	5.41	2	69.700	43.0	51.0	21.75	19.4
3	179	171½	7½	4.19	3	66.750	45.0	55.0	20.82	19.0
4	159	153	6	3.77	4	60.950	44.0	54.0	20.82	18.6
5	146	141	5	3.48	5	62.450	36.0	32.5	20.07	17.8
6	134½	130	4½	3.34	6	62,200	36.0	29.5	20.07	18.4
7	124	Additions were made to this heat.			7	*69.950	37.5	37.5	21.57	18.4

experienced in his foundry, as the floor contains practically no moisture and is protected by ribbed iron plates in front of the furnaces and at points where heated crucibles are stored. Occasionally, when crucibles broke and the metal flooded the floor, an explosion occurred. In this case the damaged section of the floor was repaired with new cement on Saturday and allowed to dry over Sunday.

Concrete Floors.

Mr. Patch asked whether a concrete floor in a gallery is not dryer than when in contact with the ground and whether it is not less liable to cause explosions. Mr. Barnes replied that a concrete floor on the ground should be waterproofed by first laying a thick layer of broken limestone on the ground and on top of this a layer of asphalt, 1 to 2 inches thick. This would prevent the moisture of the ground from passing through to the cement, which is laid on top of the asphalt and forms the working floor of the foundry. W. R. Webster raised the question of the accuracy of the meters in measuring the oil, and wanted to know if they were calibrated. The question was answered by J. V. Hunter, assistant to Mr. Barnes, who explained the operation of the meters. This system was described in THE FOUNDRY, April, 1910, page 82. Mr. Hunter stated that they had used 100,000 gallons of oil per annum and that the readings of the meters were within 1 per cent of accuracy, as proved by the total amount of oil purchased. Mr. Corse asked if the suction system of pumping oil, as described by Mr. Barnes, was considered better than the pressure system, where the oil, instead of being pumped, was forced out by air pressure applied inside the tank. Mr. Barnes stated that this system was not allowed by the board of fire underwriters and no insurance could be obtained on such installations, and even with the use of pumps the rules were very stringent as to the emptying of all the oil from the circulating system at night. There was some difference of opinion on this point, one member stating that he had used the pressure system for some time without interference from the insurance companies.

Inspection of Pittsburg Plants.

On Thursday afternoon a large delegation, representing the American Brass Founders' Association, visited the plants of the Westinghouse Air Brake Co., Wilmerding, Pa.; Homestead plant of the Carnegie Steel Works, Homestead, Pa., and the Mesta Machine Co., West Homestead, Pa. In the evening the members of this organization were the guests of the Foundry and Machine Exhibition Co., at a vaudeville entertainment in the Exposition music hall.

Closing Session.

The closing session of the convention was held on Friday morning. "The Determination of Nickel in Alloys," by Prof. S. W. Parr, was read by title in the absence of the author.

"The Effect of Repeated Melting on Manganese Bronze," was the subject of an interesting paper read by Jesse L. Jones, which is presented herewith:

The smooth, clean surface, the beautiful golden color, and also the mechanical strength of manganese bronze castings, depends largely on the manner in which the ingot metal is melted. The following analysis may be regarded as typical of this alloy:

	Per cent.
Aluminum	0.14
Copper	56.61
Iron	1.50
Lead	0.01
Manganese	0.07
Tin	1.21
Zinc	40.53

In order that the above proportions may be as little changed as possible, the melting operation should be done quickly. If an oil-fired furnace is used, the time for melting a 500-pound heat should not exced 15 or 20 minutes, and the surface of the metal should be well protected. When melting in crucibles a longer period is required, but it should be as short as possible and the metal should be kept well covered with charcoal. If the melting operation is unduly prolonged considerable zinc is volatilized, and for this reason makers of the ingot metal advise brass founders to add two pounds of zinc to each 100 pounds of re-melted bronze. The iron content of the alloy is supposed to be protected from oxidation by the aluminum and manganese present, but as these metals are present only in small quantities, the extent of the protection they afford is rather limited.

When the iron becomes oxidized, castings made from the metal, have a rough, black surface and the tensile strength and ductility are much lowered. But if the oxidation has not gone so far as to produce castings with a blackened surface it may show in a coarse-grained metal, full of lemon-colored spots, which will also be weak and brittle. While it is possible to replace the zinc and aluminum lost by volatilization, it is more difficult to replace the iron and manganese because of their high melting points. The removal of the entangled or dissolved oxides of iron, copper, etc., has also to be effected if the original ductility of manganese bronze is to be restored after oxidation has occurred. Hence it is better policy to prevent deterioration than to try to doctor the metal after it is spoiled. To make a practical trial of the effects of repeated melting of manganese bronze, a number of tests

Table II.

Open Flame Furnace Heats.					Results of Physical Tests.					
Heat number.	Metal charged, pounds.	Ingots obtained, pounds.	Loss in pounds.	Loss, per cent.	Heat number.	Ultimate strength, pounds per square inch.	Elongation in two inches, per cent.	Reduction of area, per cent.	Conductivity.	Hardness (Shore).
1	985¾	949	36¾	3.72	1	74.850	31.0	29.0	24.50	20.8
2	926	856	70	7.56	2	71.000	31.5	28.5	24.00	20.2
3	845	819	26	3.07	3	66.800	42.0	45.0	22.55	19.8
4	796	768	28	3.51	4	67.750	38.0	55.2	22.92	18.4
5	742½	715	27½	3.70	5	68.050	45.0	54.5	22.92	18.4
6	700½	680	20½	2.92	6	64.650	49.0	55.0	22.00	18.8
7	660	630½	29½	4.47	7	61.500	35.0	27.5	21.12	18.4
8	616	590½	25½	4.14	8	69.650	34.5	27.5	21.12	18.2

THE STEELE HARVEY CRUCIBLE MELTING FURNACE
IN CONNECTION WITH FUEL OIL OR GAS & AIR.
MONARCH ENGINEERING CO.
BRASS
FURNACES
HANNA ENGINEERING
THE MOTCH & MERRYWEATHER MACHINERY CO.
PITTSBURG OFFICE FARMERS BANK BLDG.
GOULD & EBERHARDT

Lawlor Improved Jarring Machine Co., Pittsburg
Monarch Engineering & Mfg. Co., Baltimore
Motch & Merryweather Co., Cleveland

Osborn Mfg. Co., Cleveland
Hanna Engineering Works, Chicago
Hawley Down Draft Furnace Co., Chicago

were made, the results of which are given in Tables I and II. Heats were run in both crucible and open flame furnaces, and ingot metal was used because of its uniform character.

The Tests.

The metal charged was weighed carefully, but no special care was observed in melting, as it was done in the usual routine manner. The metal was made quite hot, as required for pouring small castings, and was run into ingots and test bars. The ingots, minus the weight of the test bars and the melting loss, were then charged again and re-melted in each successive heat. No deduction was made for shot metal in the skimmings, nor any metal that splashed on the floor while pouring, or adhered as skulls to the walls of the crucible or furnace. All losses were included in the melting loss, only the clean ingots and test bars being considered. That no unusual care was taken to keep the melting loss low is indicated by the loss in crucible heat No. 1, Table I, and no additions were made to any heat except No. 7.

The repeated melting of manganese bronze gradually lowers the ultimate strength, elastic limit, electrical conductivity and hardness of the metal. The ductility is not affected to any great extent, as shown by the elongation and reduction of area. The addition of zinc, etc., to re-melted manganese bronze is not advisable.

In the discussion that followed the reading of the paper, Hugh McPhee asked if the composition of the metal was the same in both crucible and open flame furnaces. W. J. Reardon, who assisted Mr. Jones in making these tests, stated that it was. A question was then asked regarding the nature of the fuel, used in the crucible furnaces, as the speaker considered the loss abnormal. He was informed that coke was used. W. M. Corse said that it was his impression that the average loss in melting manganese bronze was 4 per cent. Hugh McPhee was of the opinion that the loss stated was too high, and N. K. B. Patch explained that the figures given represented the average loss of a series of meltings.

Election of Officers.

Officers for the ensuing year were elected as follows:

President, L. W. Olson, Ohio Brass Co., Mansfield, O.

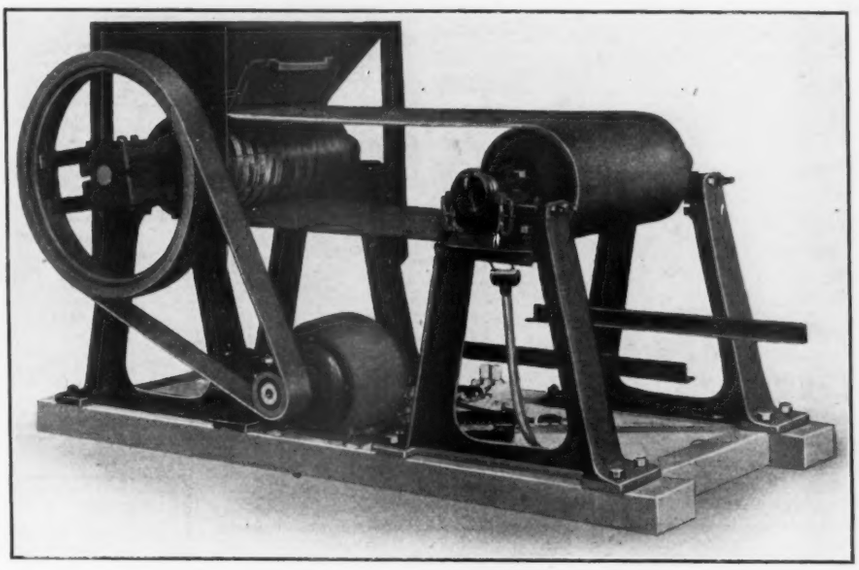
Secretary and treasurer, W. M. Corse, Lumen Bearing Co., Buffalo.

Vice presidents: J. F. Thompson, Monel Metal Co., Orford, N. J.; R. T. Roberts, National Brass & Copper Tube Co., Hastings, N. Y.; P. F. Augenbraun, Yale & Towne Mfg. Co., Stamford, Conn.; G. H. Clamer, Ajax Metal Co., Philadelphia; P. H. Mueller, Mueller Mfg. Co., Decatur, Ill.; R. C. Faunt, Faunt Bros.; Chicago; H. W. Gillett, Aluminum Castings Co., Detroit; J. Cessna Sharp, J. C. Sharp Brass Works, Chattanooga, Tenn.; N. K. B. Patch, Lumen Bearing Co., Toronto; Richard R. Mitchell, The Robert Mitchell Co., Ltd., Montreal.

Magnetic Separator

In the accompanying illustration is shown a magnetic separator, built by the Cutler-Hammer Mfg. Co., Milwaukee, which is designed to remove large pieces of iron or steel from ore, coal or rock that is to be passed through crushers and its application in the foundry is wide, inasmuch as it can be used to advantage for the removal of shot and small particles of iron from molding sand and for the separation of brass chips from machine shop turnings. When installed, a chute or other conveyor is placed underneath the magnetic pulley, into which the magnetic material is dropped. The non-magnetic material is projected some distance in front of the pulley, thereby effecting clean separation. The pulley at the head in the accompanying illustration, consists of alternate coils and steel discs concentric with the shaft, the coils being wound on steel spools doweled to the discs, which are in turn keyed to the shaft. Each coil is enclosed and protected by a cylindrical brass coil shield, which is attached to each of the two adjacent poles. Current for the coils is obtained through carbon brushes held on a pair of slip rings by self-adjusting holders.

The material to be separated is fed through a hopper to the conveyor belt, by means of which it is passed over the magnetized pulley; the magnetic matter is drawn toward the face of the pulley, clinging to the belt up to the point at which the belt leaves the pulley at the lower side. At this point it is snapped off into the chute or other conveyor provided. These pulleys are built in lengths from 16 to 36 inches and are 12 inches in diameter. The current consumed varies from 325 to 750 kilowatts and the capacities range from 1,340 to 3,000 cubic feet per hour. The pulleys are designed to operate on any direct-current voltage up to 250.



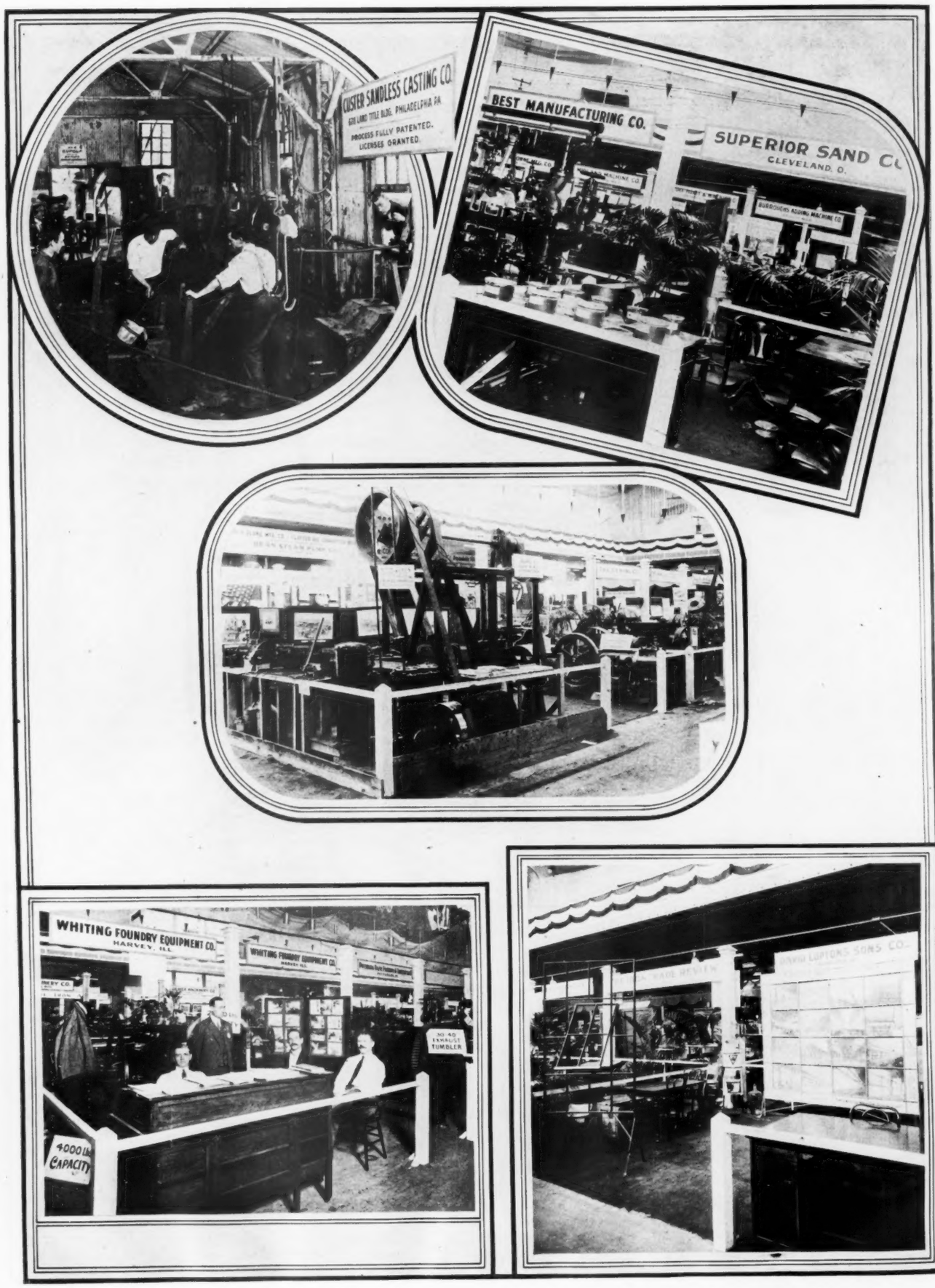
A New Magnetic Separator

Strong Gray Iron

By N. W. Shed

Question:—We have received an order for castings the specifications for which require a 2,500-pound central load on a 1 inch square test bar, 12 inches long. The deflection is placed at 0.15 inch. We would like to have a mixture that would fulfill these requirements.

Answeer:—The deflection of 0.15 inch for a load of 2,500 pounds at the center of the bar can be considered a fair requirement. Almost any mixture of moderately hard iron would give this result. To obtain a greater deflection, the use of some of the best grades of charcoal iron would be necessary, or a special semi-steel mixture would have to be used. An iron containing 1 per cent silicon, 0.06 per cent sulphur, 0.20 per cent phosphorus, 0.60 per cent manganese, 2.50 per cent graphitic carbon, and 0.80 per cent combined carbon, would give a high deflection. However, this iron might show a chill in the light sections of the casting. In attempting to obtain a high deflection it is necessary to make a hard iron, but if too hard it is liable to be white and weak. The strength and deflection specified are not standard and only indicate that the iron must be considerably stronger and more elastic than ordinary soft iron.



The Permanent Mold Foundry Operated by the Custer Sandless Casting Co., Philadelphia

Best Mfg. Co., Pittsburg; Superior Sand Co., Cleveland

Deane Steam Pump Co., Holyoke, Mass.; Geo. F. Blake Mfg. Co. and Clayton Air Compressor Works, East Cambridge, Mass.

Whiting Foundry Equipment Co., Harvey, Ill.

David Lupton's Sons Co., Philadelphia

BIG EXHIBITION OF FOUNDRY EQUIPMENT

Display of labor-saving devices for the foundry and machine shop at Pittsburg—List of the individual exhibits

CONCURRENT with the convention of the various foundrymen's organizations, held in Pittsburg during the week of May 22, was conducted the exhibition of foundry and machine shop equipment, under the auspices of the Foundry and Machine Exhibition Co. Both in number of exhibits and in extent of space occupied, the show surpassed all previous efforts, and this feature, started in Cleveland only five years ago as an adjunct of the foundrymen's meetings, promises to develop into a great, annual industrial exhibition of not only equipment and supplies for casting plants, but also of machine tools and every metal manufacturing appliance.

When the doors of the two large buildings of the Western Pennsylvania Exhibition Society were opened on Tuesday evening, May 23, practically every space was occupied, and there was an overflow of exhibits in the court between the two buildings. The number of manufacturers represented totalled 116 and approximately 35,000 square feet of exhibit space was occupied. Both buildings were magnificently decorated and the uniformity of the railings and signs produced a pleasing and harmonious effect.

Molding Machines.

Practically all of the operating exhibits were located in Mechanical Hall, which was practically converted into a machine shop and foundry, equipped with the latest labor-saving appliances. The still exhibits were grouped in the main building, and here also were displayed many tools adapted for foundry and machine shop use. Both in number and variety, molding machines were in the majority, and the number of new types shown reflected the tremendous advancement in molding machine practice in the last 12 months. Much interest was manifested in the large jar-ramming machines displayed, which are now built in sizes of sufficient capacity to ram molds weighing 50,000 pounds. The application of the jar-ramming principle to core machines has also been given a tremendous impetus in the past year, and irregular cores, regardless of size, are now rammed in this way. One manufacturer has departed from the use of compressed air for the operation of jar-ramming machines, and displayed an electrically-operated tool that attracted considerable attention. Machines were shown that embodied every conceivable combination of molding operations, and from this vast array of labor-saving tools, it is doubtful if one cannot be selected that is adapted for machine-molding the most irregular and intricate patterns.

Permament Mold Foundry.

The development of the jar-ramming molding machine, particularly the large units, has created a demand for equipment for handling sand and drawing the patterns, and numerous appliances were shown that practically complete the sequence of mechanical operation in the production of large molds. The manufacturers of lifting magnets, alive to the economies that can be effected by the use of this device in foundries, made extensive displays of their equipment, while every type of foundry crane was also shown. For melting ferrous and non-ferrous metals, furnaces of all types were exhibited and the application of the useful oil burner for lighting cupolas, skin-drying molds, etc., was demonstrated.

The permament mold foundry in which the Custer process of producing castings in cast iron molds was demonstrated, was the center of attraction throughout the week. A separate building at the side of Mechanical Hall was equipped for this purpose. The iron was melted in a 42-inch cupola furnished by the Whiting Foundry Equipment Co., Harvey, Ill., while the blast was supplied by a centrifugal air compressor installed by the General Electric Co. The permanent mold equipment, furnished by the Custer Sandless Casting Co., Philadelphia, included a 6,000-pound mold for casting a 100-pound mine car wheel; 500-pound mold for five-pound plow points; 1,800-pound mold for casting two 7½-pound bevel gears; 1,400-pound sash weight mold, and two molds for casting soil pipe fittings. Edgar Allen Custer, inventer of this permanent mold process, who was in charge of the demonstration, announced that a cast iron mold is now being perfected for casting standard cast iron car wheels, weighing from 650 to 750 pounds.

Throughout the foundrymen's convention the attendance was large and the mechanical engineers, whose spring meeting opened in Pittsburg on Tuesday, May 30, manifested a great interest in the show and crowded the exhibition buildings throughout Tuesday and Wednesday, May 30 and 31. The machine tool display was larger than at any previous show, and one exhibitor disposed of a large boring mill and numerous other small tools. Machine tool manufacturers are displaying a greater interest in these shows and a movement has already been started which will result in their joining with the builders of foundry equipment in the exhibit to be held next year.

Practically every exhibitor reported a satisfactory volume of business, and many of the tools and appliances shown were sold on the floor, while one manufacturer succeeded in disposing of his entire exhibit to one purchaser.

List of Exhibitors.

ADAMS CO., Dubuque, Ia.—Molding machines, squeezers, snap flasks, pneumatic rappers, sprue cutters, grinding stands, milling machines, automatic gear-hobbing machines; represented by C. E. Reich, W. J. Spensley, John Nicol, Ignatius Schweitering, John Berringer, Anton Haas, L. E. Marceau and Glenn Muffly.

ALBANY SAND AND SUPPLY CO., Albany.—Samples of selected grades of sand for brass, aluminum and stove plate castings; represented by L. Murray, Chas. H. Bird and Arthur T. Palmer.

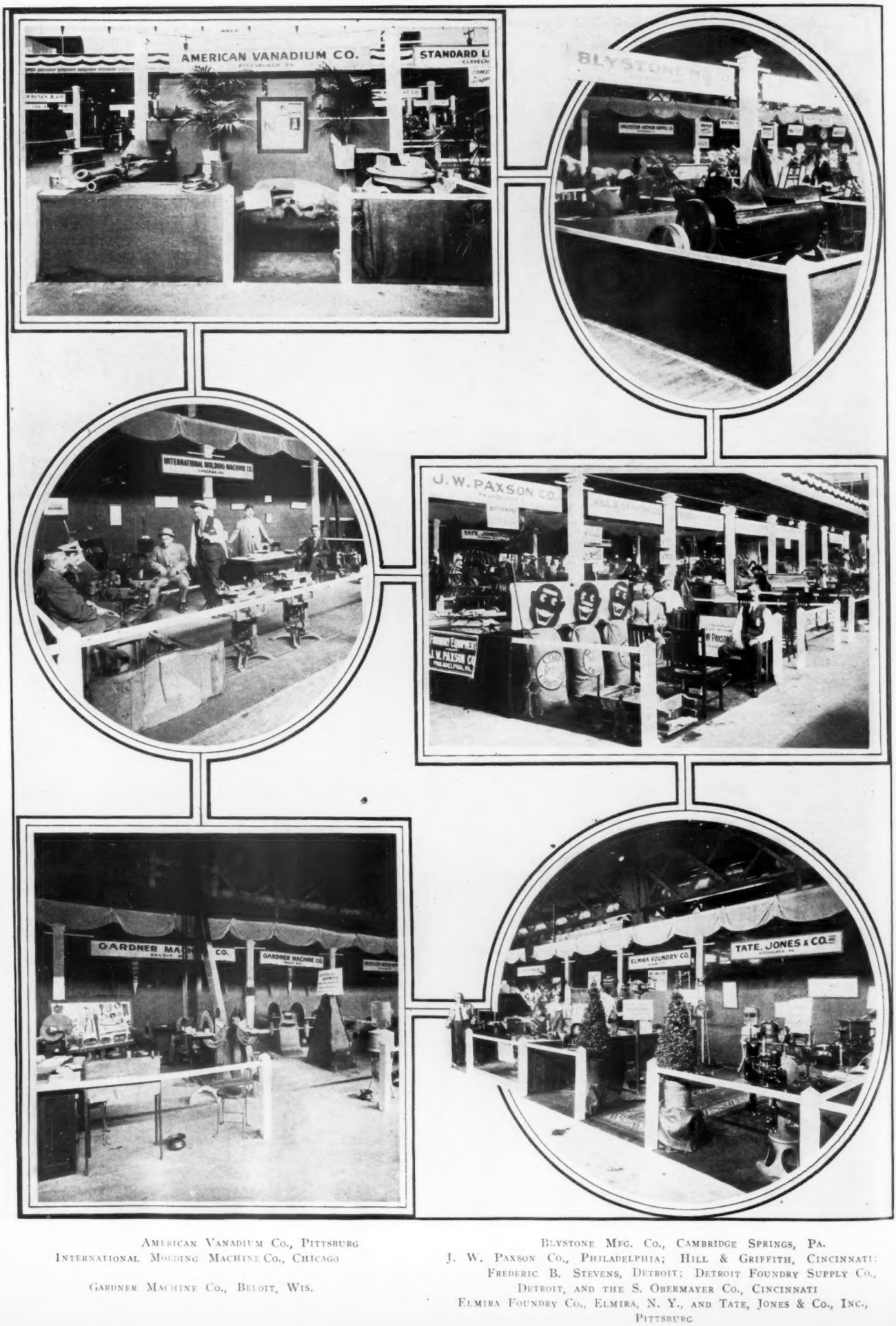
AMERICAN VANADIUM CO., Pittsburg.—Vanadium cast steel and cast iron specimens; represented by J. J. Flannery, Geo. L. Norris, C. L. Hastings and W. J. Bird.

ARCADE MFG. CO., Freeport, Ill.—Norcross jarring machines, Modern molding machines, squeezers, rotary sand sifter, match-plate hinge, and the Modern automatic molding machine with sand elevator and dropper; represented by E. H. Morgan, Chas. Morgan, L. L. Munn, F. N. Perkins, R. M. Burton, W. C. Norcross, Henry Tscherning, G. D. Wolfley, Aug. Christen, John Ludolph, Joe Stevens and H. Damman.

ATLAS CAR & MFG. CO., Cleveland.—Storage battery locomotive, new type sand blast car, portable track and side dump sand car; represented by R. S. Richards.

BAIRD & WEST, Detroit.—Solvay foundry coke; represented by E. Stoughton and C. W. Baird. Joint exhibit with Pickands, Brown & Co.

BARTLEY, JONATHAN, CRUCIBLE CO., Trenton, N. J.—Crucibles, retorts, stoppers



American Vanadium Co., Pittsburg
International Molding Machine Co., Chicago

Gardner Machine Co., Beloit, Wis.

Blystone Mfg. Co., Cambridge Springs, Pa.
J. W. Paxson Co., Philadelphia; Hill & Griffith, Cincinnati; Frederic B. Stevens, Detroit; Detroit Foundry Supply Co., Detroit, and the S. Obermayer Co., Cincinnati
Elmira Foundry Co., Elmira, N. Y., and Tate, Jones & Co., Inc., Pittsburg

and a variety of graphite specialties; represented by Samuel H. Dougherty, Lee T. Ward, Herbert D. Cole and Lewis L. Lawton.

BEST MFG. CO., Pittsburg.—Steam specialties.

BERKSHIRE MFG. CO., Cleveland.—Hand-squeezing and pattern-drawing molding machines, plain squeezers and automatic molding machines. Also a full line of snap flasks, iron flasks, etc.; represented by R. H. York, J. N. Battenfeld and C. F. Battenfeld.

BESLY, CHARLES H., & CO., Chicago.—Patternmakers' disc grinder for wood and direct-connected, motor-driven grinder for metal, pressed steel ring wheel chucks, geared lever feed tables, rotary fixture, temper taps, oil, spiral circles, cement and glue; represented by Charles A. Knill, Wm. H. Allen, Edward P. Welles and John Miller, Jr.

BIRKENSTEIN, S., & SONS, Chicago.—Brass founders' alloys; represented by E. E. Berliner, H. Birkenstein, J. B. Nieman and Lee Kahn.

BLAKE, GEORGE F., MFG. CO., East Cambridge, Mass., Clayton Air Compressor Works and Deane Steam Pump Co.—Two sizes core wiring straightening machines, dustproof, enclosed frame, splash lubricated air compressors and pneumatic sand riddles; represented by Frederick H. Thatcher, A. F. Murray, Frank Goodman, W. B. Stamford and R. L. Radcliffe.

BLYSTONE MFG. CO., Cambridge Springs, Pa.—Core sand mixers; represented by P. L. Blystone, J. F. Mather, J. A. Boland and W. E. Wright.

BROWN SPECIALTY MACHINERY CO., Chicago.—Hammer core machines; represented by Elmer A. Rich Jr., and John Laycock.

BUCH'S, A., SONS CO., Elizabethtown, Pa.—Combination jar and squeeze molding machines, aluminum snap flasks, steel flask bars, pattern cement, bottom boards, cast iron castings, cast iron flasks for the gravity molding machine with bottom boards and bars and special pouring ladle with bail; represented by R. S. Buch and George E. Bates.

BUCKEYE PRODUCTS CO., Cincinnati.—Parting compounds, binders, blackings, brass fluxes and core compounds; represented by Charles A. Goehringer and Edward Leisl.

BURROUGHS ADDING MACHINE CO., Detoit.—Burroughs adding machines; represented by Ward Gavett and H. F. Happer.

CARBORUNDUM CO., Niagara Falls, N. Y.—Carborundum and aloxite grinding wheels, carborundum fire sand and carborundum rubbing bricks; represented by George R. Rayner, W. W. Sanderson, O. C. Dobson, Anthony Dobson, J. P. McCann, C. D. Sargent and H. A. Eaton.

CHICAGO PNEUMATIC TOOL CO., Chicago.—Compound, belt-driven air compressors, sand rammers, tripod sand sifter, pneumatic geared wire rope hoists, chipping hammers, electric grinder, side spindle electric drill, pneumatic grinder and casting cleaner; represented by H. S. Hunter, F. J. May, D. F. Geissinger, E. N. Zwing and W. C. Walker.

CHISHOLM & MOORE MFG. CO., Cleveland, O.—Chain hoists, trolleys, hand power traveling cranes and malleable castings.

CLEVELAND PNEUMATIC TOOL CO., Cleveland.—Sand rammers, riveting and chipping hammers, air drills, emery grinder and air hose couplings; represented by H. S. Covey, A. Scott and J. T. Graves.

CLEVELAND WIRE SPRING CO., Cleveland.—Steel tote boxes, steel foundry barrels, steel kegs, steel shelving, steel sprue boxes, coil wire springs; represented by J. W. Campbell and C. H. Erickson.

CUTLER-HAMMER MFG. CO., Milwaukee.—Lifting magnet adapted for foundry use; represented by E. E. Brossius and Messrs. Holbrook and Chesebrough.

DALTON ADDING MACHINE CO., Poplar Bluff, Mo.—Adding machines; represented by J. L. Dalton and H. M. Cammack.

DEMING CO., Salem, O.—Hand and power pumps, fire extinguishers and white washing machines; represented by George G. Raddin, W. L. Dening and F. S. Nichols.

DETROIT CORE MACHINE CO., Detroit.—Core machines; represented by A. N. Kelley and G. Herbert Rounsifer.

DETROIT FOUNDRY SUPPLY CO., Detroit.—Represented by M. S. Fox and W. Bruce Howard.

DETROIT HOIST & MACHINE CO., Detroit.—Pneumatic geared hoists, pneumatic motors, pneumatic winches; represented by J. C. Fleming and F. B. Fleming.

DIXON, JOSEPH, CRUCIBLE CO., Jersey City, N. J.—Crucibles for both brass and steel melting, special shapes and formulas for various purposes, phosphorizors, stirrers, skimmers, stoppers, nozzles, sleeves, etc., graphite refractories, foundry facings, motor brushes and graphite products; represented by Dudley A. Johnson, F. R. Brandon, John A. Condit and Frank Krug.

DOGGETT, STANLEY, New York.—Foundry specialties, parting compounds, manganese dioxide, soapstone, graphite facing, powdered charcoal, dioxide of manganese flux, ferro-manganese, ferro-silicon, iron and steel cement, soapstone, crayons and pencils; represented by Stanley Doggett.

ELECTRIC CONTROLLER & MFG. CO., Cleveland.—Lifting magnets, controllers and automatic motor starters; represented by J. S. McKee, J. F. Motz, H. W. Eastwood and C. E. Hanna.

ELMIRA FOUNDRY CO., Elmira, N. Y.—Power ramming, roll-over core machines, pasting and venting devices; represented by A. M. Loudor, Thomas Jones and J. D. McCann.

FELT & TARRANT MFG. CO., Chicago.—Comptometer adding and calculating machines; represented by J. C. Nevins, S. C. Brown and W. D. Shimp.

THE FOUNDRY, Cleveland. — Represented by John A. Penton, A. O. Backert, R. E. Densmore, W. A. Tenwinkel, J. C. Eppens, H. Cole Estep and C. Vickers.

H. H. FRANKLIN MFG. CO., Syracuse, N. Y.—Die castings, represented by H. V. Skinner.

GARDNER MACHINE CO., Beloit, Wis.—Patternmakers' disc grinders, single head disc grinders, double head disc grinders, abrasive discs and disc grinders' supplies; represented by F. N. Gardner, F. E. Gardner and L. W. Thompson.

GENERAL ELECTRIC CO., Schenectady, N. Y.—Centrifugal air compressor.

GOLDSCHMIDT THERMIT CO., New York.—Full line of metals produced free from carbon, heating thermic cans, titanium thermit cans, thermit welding process and appliances; represented by Wm. C. Kuntz, E. A. Beck, H. S. Mann and Wm. R. Hulbert.

GRACETON COKE CO., Graceton, Pa.—Foundry coke, represented by C. M. Lingle.

GRAF MOLDING DEVICE CO., Louisville, Ky.—Aluminum roll-up match-plates and hingeless snap flasks; represented by T. H. Graf and A. N. Webb.

HANNA ENGINEERING WORKS, Chicago.—Kathbone multiple molding machine, pneumatic shakers, oscillating riddle, sand blast machines, revolving dumping riddle, mold dryer and Hanna riveter; represented by W. L. Laib, James T. Lee and F. H. Scantlebury.

HARBISON-WALKER REFRACTORIES CO., Pittsburg.—Ordinary shapes and standard cupola blocks in fire brick; represented by Hay Walker, J. J. Brooks Jr., K. Seaver, J. E. Morgan, W. N. McKnight, V. A Giesey, G. S. Troxell and S. A. Bixler.

HAUCK MFG. CO., New York.—Oil burning appliances, including cupola lighters, ladle heaters, core oven and furnace burners, mold dryers, pre-heating and brazing outfits; represented by A. E. Hauck, A. P. Link, A. H. Stein and H. E. Giersch.

HAWLEY DOWN DRAFT FURNACE CO., Chicago.—Metal melting furnaces; represented by F. O. Bartlett, H. J. Stow, D. J. O'Brien, H. E. Schwartz and C. M. Bleyer.

HERMAN PNEUMATIC MACHINE CO., Zelienople, Pa.—Jar ram stripping plate machine, jarring molding machines with roll-over and pattern-drawing device and parring molding machine; represented by A. M. Frauenheim, M. L. Heyl, Charles Herman, Alfred Herman, Andrew Rodgers and C. E. Pettee.

HERRUTH CORE OIL CO., Chicago.—Small electric core oven and core oil; represented by George A. Humelbaugh.

HILL & GRIFFITH CO., Cincinnati.—Represented by John Hill, John Glass, William Oberhelman and Harry Taylor.

HUNTER SAW & MACHINE CO., Pittsburg, Pa.—Solid tooth saws, inserted tooth saws and saw sharpening machines; represented by F. A. Hunter, J. A. Carrothers and G. W. Agerter.

IDEAL FURNACE CO., Chester, Pa.—Brass melting furnaces; represented by P. J. Sweeney.

INGERSOLL-RAND CO., New York.—Twelve-inch stroke air compressor, pneumatic chipping, caulking and scaling hammers, pneumatic riveting hammers, sand rammers for bench and floor work, pneumatic motor hoists, pneumatic stationary motors, and pneumatic piston and rotary drills; represented by W. H. Armstrong, W. A. Armstrong, E. P. Mooney, H. E. Metcalf, W. B. Brendlinger, James Moran and J. L. Kelly.

INTERNATIONAL MOLDING MACHINE CO., Chicago.—Light and heavy designs of stripping plate machines, turn-over draw machines, coremaking machines and squeezers; represented by Edward A. Pridmore, W. W. Miller and J. W. Dopp.

INTERSTATE SAND CO., Zanesville, O.—Molding sand for iron and steel molding; represented by L. K. Brown and E. M. Ayers.

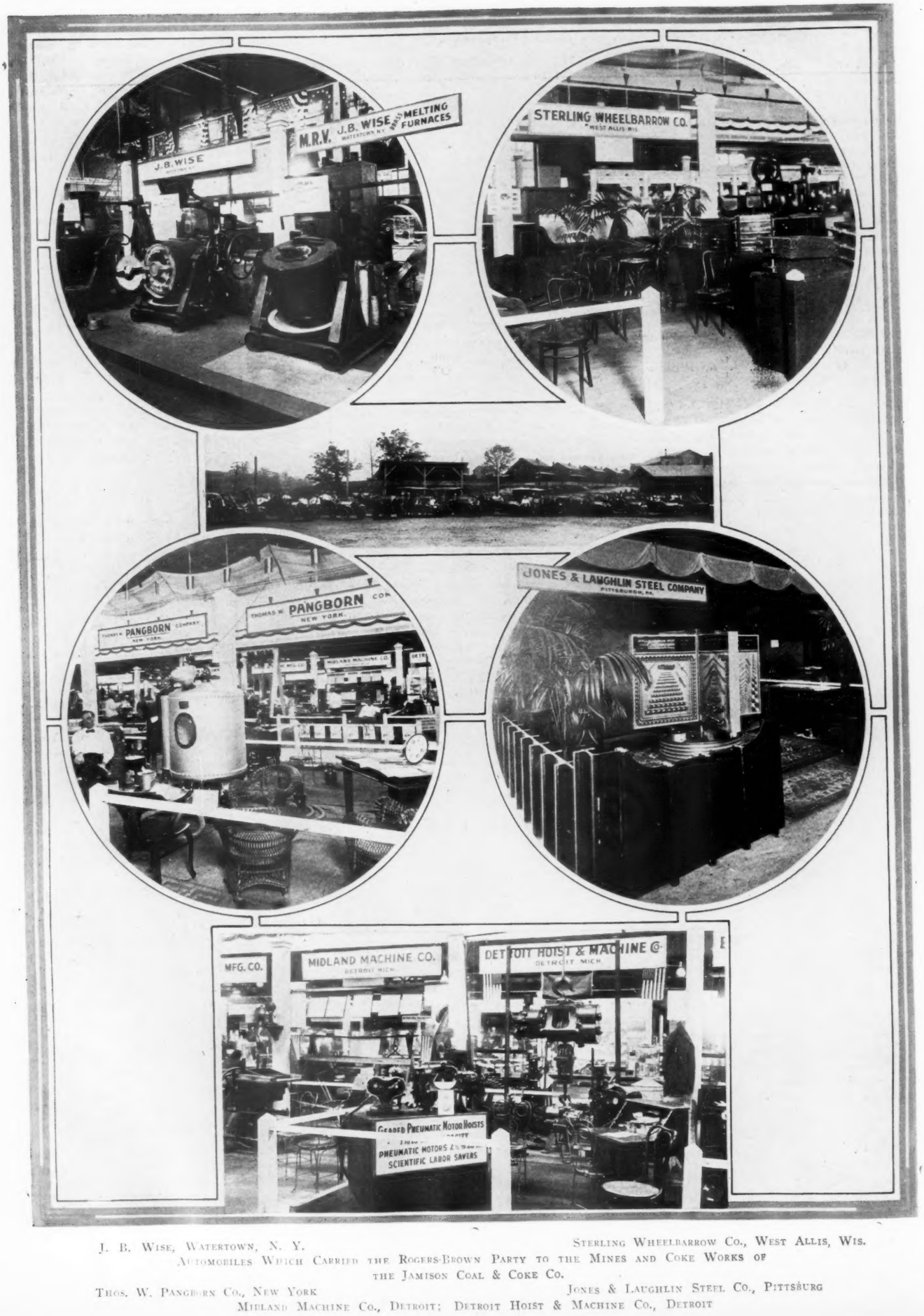
The Iron Trade Review, Cleveland, O.—Represented by John A. Penton, A. O. Backert, R. E. Densmore, H. Cole Estep, W. A. Tenwinkel, E. W. Word, H. A. Andresen and L. P. Sutter.

JAMES JILES CO., Pittsburg. — Molding, loam and core sand, common loam for open-hearth furnaces, etc.; represented by John W. Jiles and C. L. Kelly.

JONES & LAUGHLIN STEEL CO., Pittsburg.—Steel products.

KEYSTONE COAL AND COKE CO., Pittsburg.—Coal and coke; represented by E. M. Gross, W. F. Elwood and A. F. Syroth.

KILLING'S, E., MOLDING MACHINE WORKS, Davenport, Ia.—Stripping plate machine, roll-over machine, multiple cylinder,



J. B. Wise, Watertown, N. Y. Sterling Wheelbarrow Co., West Allis, Wis.

Automobiles Which Carried the Rogers-Brown Party to the Mines and Coke Works of the Jamison Coal & Coke Co.

Thos. W. Pangborn Co., New York Jones & Laughlin Steel Co., Pittsburg

Midland Machine Co., Detroit; Detroit Hoist & Machine Co., Detroit

jarring machine, jarring rockover machine, and two sizes of automatic squeezers; represented by E. Killing, A. W. Fox, C. P. Aabye and George Heck.

LAWLOR IMPROVED JARRING MOLDING MACHINE CO., Pittsburg.—Lawlor improved Jarring molding machines; represented by Ralph W. Hills, Robert Sweeney and J. J. Lawlor.

DAVID LUPTON'S SONS CO., Philadelphia.—Steel sash for side walls, Pond continuous sash for monitor and saw-tooth roofs, rolled steel skylight and photographs and drawings of designs for foundry and forge shops; represented by Clarke P. Pond and W. C. Scott.

McCORMICK, J. S., CO., Pittsburg.—One five-ton and one 10-ton continuous sand screen and mixing machine, general foundry supplies and facings; represented by J. S. McCormick, T. E. Malone, S. R. Costley and R. H. Mills.

McCOY & BRANDT, Pittsburg.—Motor starters and controllers manufactured by Allen-Bradley company, Milwaukee; represented by H. E. McCoy.

MIDLAND MACHINE CO., Detroit.—Hand rammed, roll-over molding machines and foot jolt core machines; represented by George L. Grimes.

MONARCH ENGINEERING & MFG. CO., Baltimore.—Furnaces using oil or gas as fuel for melting and heating, core ovens, steel foundry ladle, heating equipment, aluminum furnaces, bolt heating furnaces, blowers, etc.; represented by H. D. Harvey and David R. Steele.

MORNER & SMITH, Dayton, O.—Patterns and aluminum snap flasks; represented by Louis Morner and Charles D. Smith.

MOTCH & MERRYWEATHER MACHINERY CO., Cleveland.—Bullard vertical turret lathe, Gould & Eberhardt shaper, Gould & Eberhardt hobbing machine, Lapointe vertical keyseater, Lapointe broaching machine, Heald twist drill grinder and Ransom motor-driven dry grinder; represented by E. P. Bullard, F. L. Eberhardt, G. E. Merryweather, E. C. Keener, J. P. Ransom and E. C. Batchelar.

MOTT SAND BLAST MFG. CO., Chicago.—Sand blast air compressor and painting apparatus; represented by David Mayer.

MUMFORD MOLDING MACHINE CO., Plainfield, N. J.—Jolt ramming molding machines, high trunnion squeezers, plain squeezers, split pattern machine and pneumatic hand traveling crane; represented by E. H. Mumford, Carl Falk, E. M. Huggins, F. W. Hamel and A. J. Goss.

NATIONAL CORE OIL CO., Buffalo.—Cores and samples of various grades of oil; represented by C. H. Cotton, P. L. Crandall, C. M. Anderson, J. J. McCarty and B. J. Cummins.

NORTHERN ENGINEERING WORKS, Detroit.—Electric crane trolley and joint exhibit with Cutler-Hammer Mfg. Co., Milwaukee.

NORTON CO., Worcester, Mass.—Grinding wheels, alundum and crystolon, abrasive materials, oil stones, crystolon sharpening stones, alundum refractories consisting of small electric furnace parts, cores, tubes, muffles, crucibles, combustion boats, filtering dishes, etc., for laboratory use; represented by George S. Welker and N. C. Hilton.

OBERMAYER, S., CO., Cincinnati.—Foundry supplies; represented by E. D. Frohmann and S. T. Johnston.

OHIO SAND CO., Conneaut, O.—Molding sand; represented by U. E. Kanavel and F. E. Gordon.

OLIVER MACHINERY CO., Grand Rapids, Mich.—Pattern and flask-making machinery, saw benches, band saws, hand jointers, surface planers, wood lathe, speed lathes, patternmakers' bench, universal tool grinders, disc sander, vertical spindle and disc sander, vertical spindle borer and wood trimmers and the Oliver universal wood milling machine; represented by Joseph W. Oliver, George F. Reinhard, A. S. Kurkjian, Walter Mentzer, Arthur Blake and R. A. Smith.

ORENSTEIN-ARTHUR KOPPEL CO., Pittsburg.—Steel dump car, platform car, turntable, portable track, etc.; represented by B. H. Behrens.

OSBORN MFG. CO., Cleveland.—Plain jolt molding machines, core jarring machines, roll-over rock-down molding machines, direct draw roll-over machines, rock-over molding machines, flask stripping machines, stripping plate machines, drop plate squeezing machines and mechanical pattern drawing machines; represented by H. R. Atwater, F. D. Jacobs, E. T. Doddridge, J. H. Galloway and W. J. Halliday.

PANGBORN, THOMAS W., CO., New York.—Sand blast machines; represented by J. C. Pangborn and Harry D. Gates.

PAWLING & HARNISCHFEGER CO., Milwaukee.—Single line grab or clam shell bucket in connection with monorail electric hoist, crane controllers, electric hoists and I-beam trolleys; represented by George L. Mead and F. P. Breck.

PAXSON, J. W., CO., Philadelphia.—Foundry supplies; represented by Howard M. Bougher, W. Scott Thomas, Howard Evans and Ira V. Kremer.

PETERSON, T. J., CO., Chicago.—Core oils and compounds; represented by George A. Burman, J. Purvis, Robert Brandt, George W. Doty and H. S. Peterson.

PICKANDS, BROWN & CO., Chicago.—Display of Solvay coke; joint exhibit with Baird & West, Detroit; represented by B. T. Bacon, E. A. Bateman, G. A. T. Long and J. A. Galligan.

PITTSBURG STEEL FOUNDRY, Pittsburg.—Cast steel open-hearth ladle, cast steel charging box, swinging grinder; represented by E. R. Williams.

PITTSBURG VALVE FOUNDRY & CONSTRUCTION CO., Pittsburg.—Valves, castings, etc.

PRIDMORE, HENRY O., Chicago.—Stripping plate machines, rock-over drop machines, electric motor-driven jarring machines; represented by R. E. Turnbull, D. F. Eagan, A. V. Magnuson and Henry A. Pridmore.

ROBINSON AUTOMATIC MACHINE CO., Detroit.—Automatic machines for all kinds of metal polishing; represented by C. F. Coda.

ROCKWELL FURNACE CO., New York.—Centric pouring crucible furnace; represented by F. S. Garrett, W. S. Quigley, A. W. Moyer and S. L. Barnes.

ROGERS, BROWN & CO., Cincinnati.—Pig iron, coke, ferro-manganese and fluor spar; represented by Thos. A. Wilson, J. Raymond Morehead, Harry S. Philson, Wm. P. Cheney, H. B. B. Yergason and James R. Darragh.

SAND MIXING MACHINE CO., New York.—Auto sand mixer; represented by Wm. A. Heartt, Hutton H. Haley, John Bradley, B. F. Doup and V. E. Minnich.

SELLERS, WILLIAM, & CO., INC., Philadelphia.—Centrifugal sand mixing machine, belt-driven and motor-driven; drill grinding machine, motor-driven; universal tool grinding and shaping machine; represented by Edward L. Holljes.

SHEPARD ELECTRIC CRANE AND HOIST CO., Montour Falls, N. Y.—Trolley for three-motor electric traveling crane with cage, including the controllers, cage-controlled electric traveling hoist and back-geared electric motor; represented by Wm. C. Briggs, Henry M. Hallett, G. H. Wood, Chas. W. Ingalls, Norman P. Farrar and Wm. A. Battey.

SLY, W. W., MFG. CO., Cleveland.—Miniature display of cleaning mills, cinder mill and dust arrester and sand blast equipment and machines; represented by H. J. Norris, G. J. Fanner and H. R. Morse.

SMITH, J. D., FOUNDRY SUPPLY CO., Cleveland.—Foundry supplies; represented by J. S. and Pierce Smith.

STANDARD LINSEED CO., Cleveland.—Samples of core oils; represented by N. Weisenberg, A. C. Bernsteen and H. G. Tremmel.

STANDARD SAND & MACHINE CO., Cleveland. — Machinery for treating sands for all kinds of foundry practice, including a mixing, rolling, crushing and blending plant, batch mixers, power adjustable screen and pulverizing disintegrating machine; represented by H. E. Boughton, J. A. Boughton, E. J. Smith and Mr. Morgan.

STERLING WHEELBARROW CO., West Allis, Wis.—Rolled steel foundry flasks; represented by I. R. Smith and John L. Kirk.

STEVENS, FREDERIC B., Detroit.—Foundry supplies; represented by Frederic B. Stevens.

SUPERIOR SAND CO., Cleveland.—Molding sands for heavy, medium and light gray iron, malleable, brass and aluminum castings; represented by W. H. Smith and H. C. Koontz.

TABOR MFG. CO., Philadelphia.—Standard power squeezing machines, roll-over machines, shockless jarring machines, combined jarring and roll-over machines, combined jarring and squeezing roll-over machines and Taylor universal tool grinder; represented by John T. Ramsden, S. Newbold, C. W. Coleman, J. H. Coleman and C. H. Ellis.

TATE, JONES & CO., INC., Pittsburg.—Brass crucible furnace, oil pumping, heating and regulating system, oil burners, portable burner for ladle drying and cupola lighting, etc., represented by R. G. Kirkwood, J. M. Tate Jr., C. F. France and J. C. Whitfield.

TAYLOR INSTRUMENT COMPANIES, Rochester, N. Y.—Recording pyrometer, radiation pyrometer and other small instruments; represented by Ralph C. Schwanz.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—Represented by H. C. Woodruff, Frank E. Goddard, Roy A. Corrigan and James G. Drought.

WADSWORTH CORE MACHINE & EQUIPMENT CO., Akron, O.—Wadsworth improved coremaking machines, core ovens, sand mixing and compound mills; represented by George H. Wadsworth.

WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg.—Motors and controllers for direct and alternating current and variable speed work; represented by B. Wiley, F. H. Herzsch, J. H. Klinck, E. M. Wise, W. B. Wilkinsin and E. B. Townsend.

WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill.—Standard heavy duty exhaust tumbler with steel plate barrel and lever type door fastener, spur geared crane ladle with standard gear cover, worm geared crane ladle, truck for crane ladle and standard turntables; represented by G. R. Brandon, C.

BERKSHIRE MFG. CO., CLEVELAND; PITTSBURG STEEL FOUNDRY, PITTSBURG

E. KILLING'S MOLDING MACHINE CO., DAVENPORT, IA.

HENRY E. PRIBMORE, CHICAGO

STANDARD SAND & MACHINE CO., CLEVELAND

CUTLER-HAMMER MFG. CO., MILWAUKEE; NORTHERN ENGINEERING WORKS, DETROIT

A. Hardy, A. H. McDougall, R. H. Bourne, T. S. Hammond, J. Hyslop, R. E. Prussing, N. S. Lawrence, G. E. Jones, W. B. Lewis and W. Mayor.

WHITNEY KEMMERER CO., Pittsburg.—Foundry coke, represented by C. S. Bygate.

WILLIAMS, G. H., CO.—Hoisting, conveying and excavating machines; represented by E. P. Lord.

WISE, J. B., Watertown, N. Y.—M. R. V. brass melting furnaces of the tilting type with permanent crucible using coke as fuel, represented by R. F. Goyne and R. J. Ryan.

YALE & TOWNE MFG. CO., New York.—Hand and electric hoists with trolley running on I-beam; represented by H. R. Butler, A. W. Patterson Jr., and T. J. White.

Electrically-Driven, Jar-Ramming Molding Machine

An electrically driven, jar-ramming molding machine, equipped with a stripping plate, built by Henry E. Pridmore, Chicago, is shown in the accompanying illustrations. The plain jar-ramming machine is not equipped with the stripping plate equipment and is adapted for the same class of work as other molding machines of the jar-ramming type. The machine exhibited at the foundrymen's convention at Pittsburg was of the plain type, equipped with a table, 30 x 36 inches. The power is transmitted from the motor shaft to an enclosed worm and worm gear connected to a shaft to which a cam is attached which operates a bell crank lever having a leverage of two to one. The cam contacts with a roller on one end of the bell crank. The table, which is well-ribbed to uniformly distribute the blow, drops on a wood fiber ring on the base or anvil of the machine. Only a 2½-horsepower motor is required to operate this machine, which has a capacity for ramming molds weighing two tons and strikes 175 blows per minute. The drop of the table is ¾ inch. On the plain jar-ramming machine, exhibited at Pittsburg, a half mold for a gas engine casting, molded in a 21 x 44-inch flask, 8 inches deep, was rammed with 42 blows in less than one-half minute. The motor is entirely enclosed and can be located at any convenient point near the machine. The current consumption is exceedingly low and the power cost is consequently very small. The machine is operated by a friction clutch with lever attachment.

The electrically operated machine, shown in Fig. 1, is equipped with a stripping plate and represents a further development of this type of machine. The patterns mounted on the pattern plate consist of six wagon skeins molded in one flask. The stripping plate is not attached to the table, but rests on the four lifting posts, by means of four pins on the stripping plate which pass through openings in the jarring table and rest in recesses in the tops of the four posts. In Fig. 2 the four posts are shown raised, thereby lifting the stripping plate. The posts are raised and lowered in supports attached to the base of the machine. The posts are lifted simultaneously by two bars, on either side of the machine, actuated by a crank movement, which contact with rollers on pins attached to the bottoms of the lifting posts. While the stripping operation, on the machine shown, is actuated by a hand wheel, it is the intention to drive the stripping plate mechanism by power transmitted from the same motor that operates the molding machine.

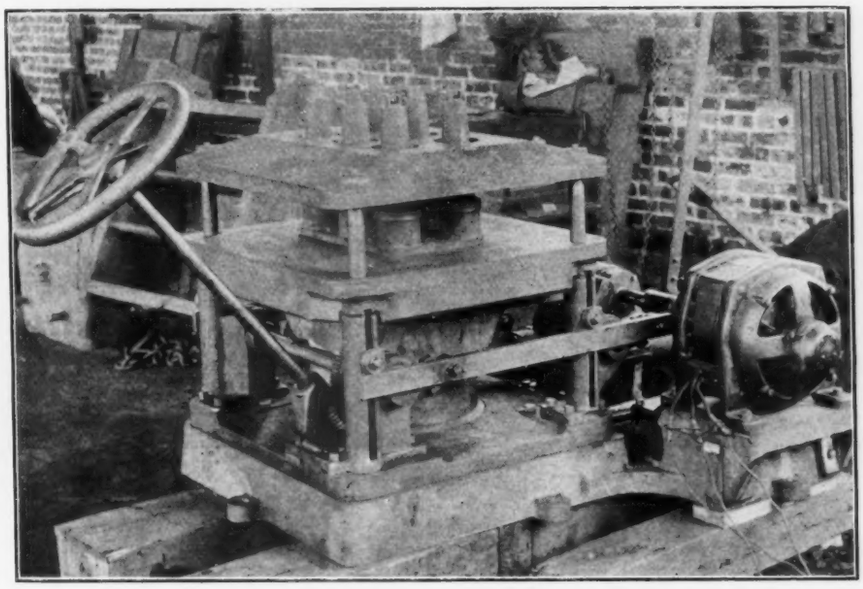


FIG. 2—ELECTRICALLY-OPERATED, JAR-RAMMING MACHINE, WITH STRIPPING PLATE RAISED

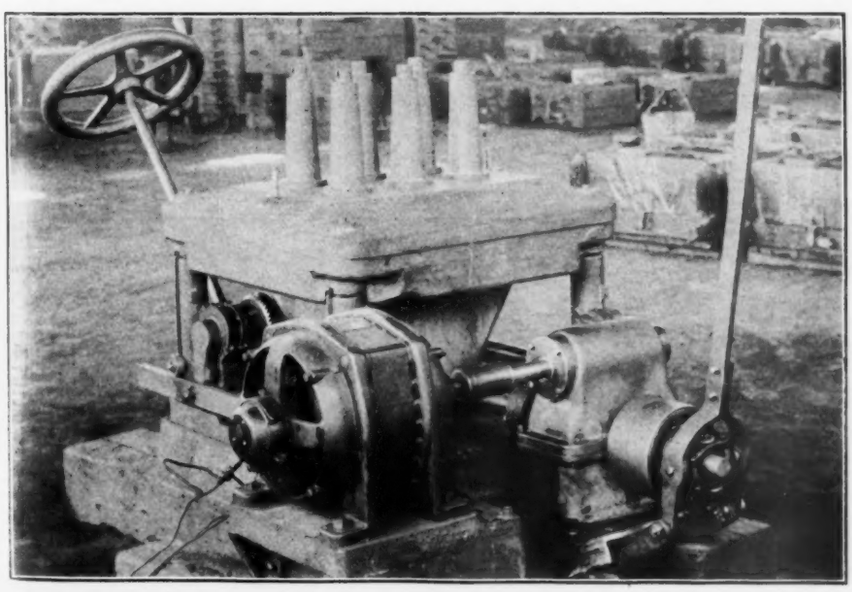


FIG. 1—ELECTRICALLY-OPERATED, JAR-RAMMING, STRIPPING PLATE MOLDING MACHINE

The Mumford Molding Machine Co., Plainfield, N. J., manufacturers of a large line of molding machines for light and heavy castings, has recently received the following orders for large jolt-ramming machines: One 32-inch jolt rammer with table 6 x 9 inches, from the Tennessee Coal & Iron Co., Birmingham, Ala.; one 20-inch and one 16-inch jolt rammer, from the Pennsylvania Steel Co., Steelton, Pa., and one 16-inch and one 14-inch jolt rammer are included in a large order for molding machines shipped to the Treadwell Engineering Co., Easton, Pa. The Mumford Molding Machine Co. also reports the receipt of a large number of orders for small vibrator machines.

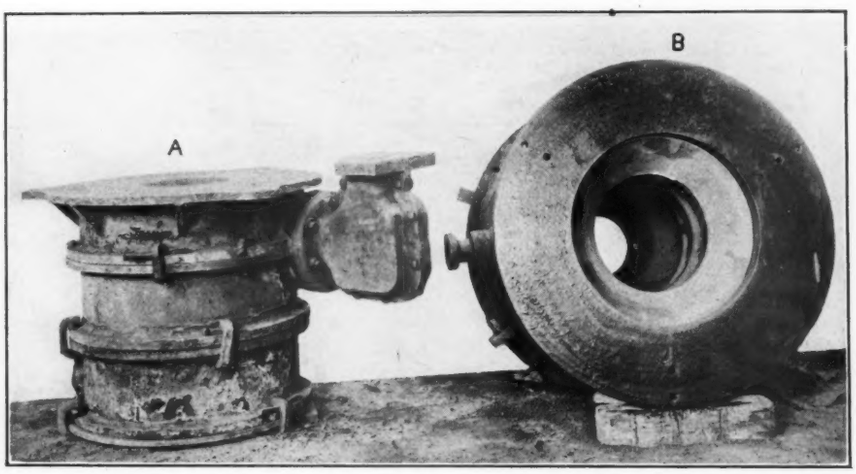


FIG. 1—THE MOLD WITH THE DRAG READY TO RECEIVE THE CHILL; AT *B* THE RINGS ARE SHOWN ASSEMBLED

New Process of Casting Grooves in Chilled Rolls

A patent was recently granted Alfred I. Crook, which has been assigned to the Philadelphia Roll & Machine Co., Philadelphia, covering a new method of making chilled rolls with the grooves for the various passes cast in. In Fig. 2 are shown the various parts of the mold before assembling, *A* being the pouring gate, *B* the top section of the mold, *C* the rings for forming the grooves and *D* the lower section of the mold. At *A*, Fig. 1, is shown the drag in position to receive the chill and at *B* are shown the rings assembled and secured within the main shell. Practically all of the chill-pass rolls are made by inserting chill rings in an ordinary sand mold or in chill molds split or parted vertically to permit their removal from the roll after cooling. The objectionable feature of the first of these methods is claimed to be the difficulty in obtaining sufficient chill in the passes which is due partly to the tendency to use light chill rings and partly to the fact that the ring is surrounded by sand which is a poor conductor of heat and thus destroys the desired chilling effect. The second method is very economical, but the objectionable features are due to the tendency of a roll cast in split or parted chills to develop a crack longitudinally, conforming with the joint of the chill. Another objection against the use of the ordinary divided chill is that the passes, being a part of the main body of the chill, cannot change their positions to conform with the contraction of the roll after casting. Internal strains are thus produced which are frequently sufficient to cause cracking and even breakage of the roll.

By the method practiced by the Philadelphia Roll & Machine Co., the chill rings are fitted and temporarily secured in a solid outside shell of such a form that it can easily be removed intact from the roll after cooling. The rings which form the passes are released shortly after the roll is poured and are free to change their position within the shell, thereby avoiding all undue resistance to the natural contraction of the cooling metal. This prevents internal stresses due to the casting of an irregular body inside of an unyielding mold. The use of a solid chill also entirely eliminates the possibilities of longitudinal cracks in the roll and as the chill rings are uniformly in contact with the solid chill shell, which is an excellent conductor of heat, it is possible to obtain the desired amount of chill on the grooves of the roll.

The Orenstein-Arthur Koppel Co., Chicago, announces the removal of its offices, formerly located in the Monadnock block, to 631 to 633 Peoples Gas building.

Book Reviews

Pocket-Book of Mechanical Engineering, by Charles M. Sames; bound in flexible leather; 4 x 6⅝ inches, 220 pages. Furnished by THE FOUNDRY for $2, postpaid.

This is the fourth edition of this work and has been extensively revised and considerably enlarged. The pocket-book is of such a size that it can be readily carried in the pocket without inconvenience and will prove of exceptional value to designers of machinery, as it contains a comprehensive collection of formulas, data and constants relating to the proportioning of machine parts, assembled machines and motors. New matter has been added on nearly one hundred subjects and those of interest to foundrymen deal chiefly with new alloys and alloy steels, steel castings, tenacity of metals at abnormal temperatures, etc.

Heat, by J. Gordon Ogden; 4¾ x 6⅜ inches, 119 pages, illustrated. Supplied by THE FOUNDRY for 25 cents.

This is one of a series of handbooks on industrial subjects intended to convey mechanical information in a manner easy to understand without special technical training. The first chapter gives a definition of heat and describes the means by which it is measured, and is followed by other chapters on "How low temperatures are produced" and "Some effects of low temperatures upon matter." In the chapter on the production and uses of high temperatures the thermit reaction is discussed and its industrial application illustrated. Other subjects discussed, include "High Temperatures and the Rare Metals," "How Heat Travels," "Expansion and Contraction," "Energy and Fuels," "Steam, Boilers and Engines," etc. This little work is written in an interesting, descriptive style free from technicalities, and combines instruction and entertainment in a manner that should make it highly popular.

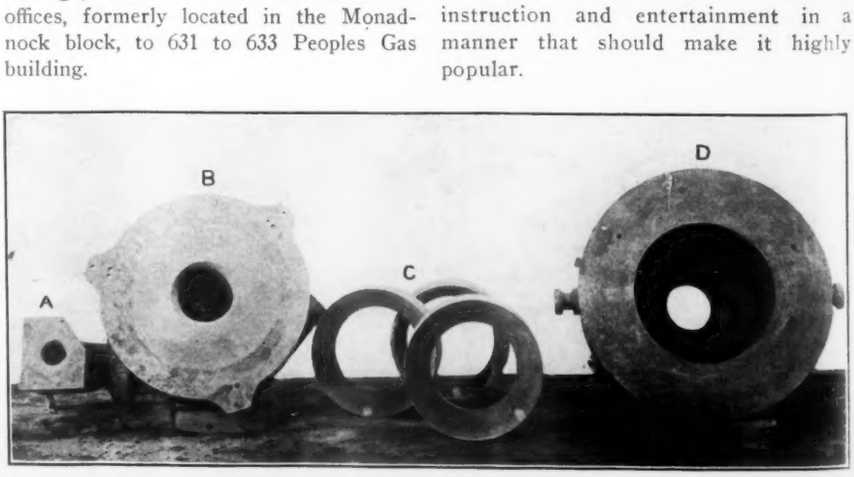


FIG. 2—PARTS OF THE MOLD FOR CASTING A GROOVED ROLL BEFORE ASSEMBLING

LIFTING MAGNETS FOR FOUNDRY USE*

Economies effected in handling pig iron, scrap, castings, etc.---Application of the magnet to foundry service

By H. F. Stratton

IN GENERAL, a device becomes an economic necessity to an industry when its installation will yield a reasonably large return on the investment, and when the device has demonstrated, through several years of actual service, that it can be considered reliable and beyond the experimental stage. The word *necessity* is chosen advisedly, because with the existence of such a device some manager, more sagacious than the average, will make the installation, after which the insistent demands of competition will then compel the general adoption of this economic necessity.

An analysis of such figures as the speaker has been able to secure, relating to the tonnage and the cost of handling of the pig used by the foundries in this country, seems to indicate that the lifting magnet is becoming an economic necessity to foundries producing a large proportion of the total foundry tonnage.

There appear to be three huge businesses which can profitably use lifting magnets for the transporting of iron and steel products.

First, the steel industry, with probably 10,000,000 tons annually which can be economically handled by the magnet, and in this industry the magnet found rapid and extensive use, with savings to the steel mills of probably close to $1,000,000 annually.

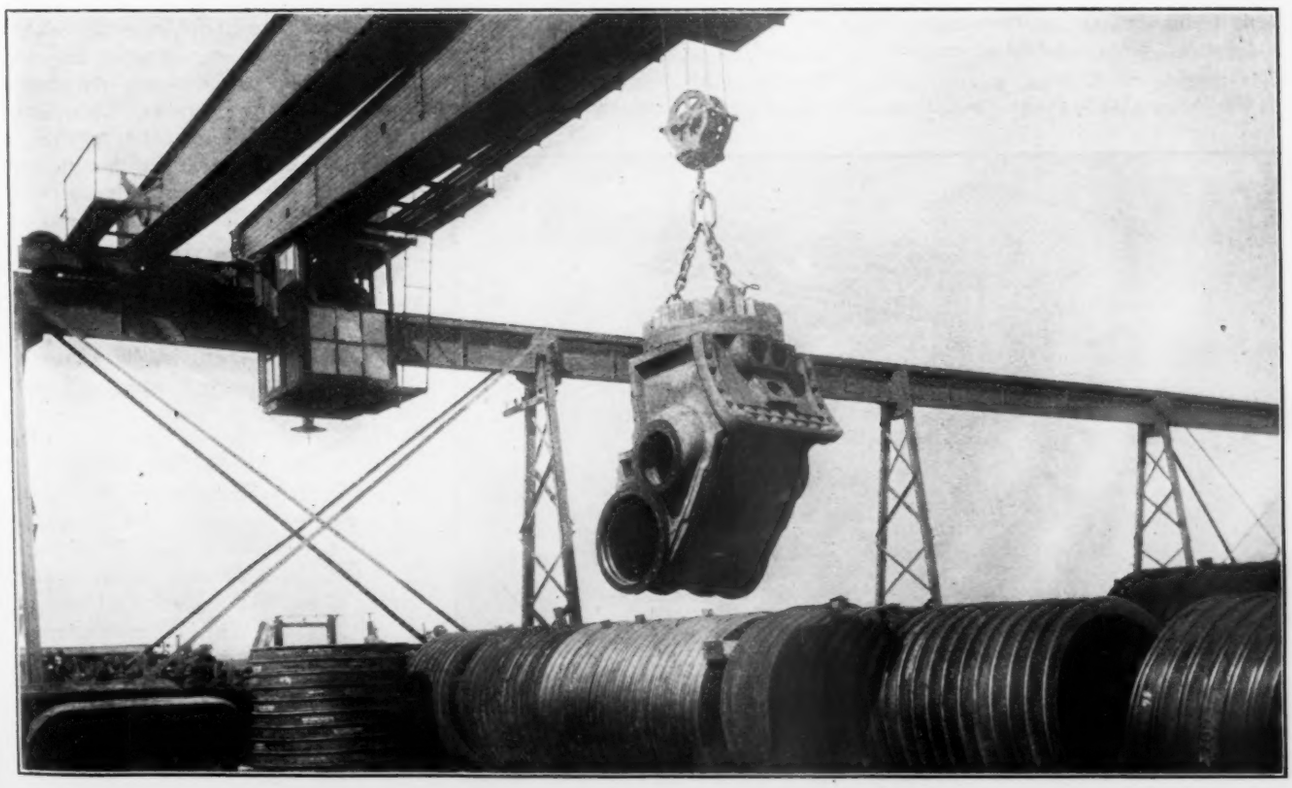
Second, the railroads have discovered that magnets are large money savers in the handling of their scrap material, and probably 100 lifting magnets are at present in use at the scrap docks operated by the various railroads throughout this country. In several cases the economies effected by the use of magnets, in handling railroad scrap, have proven to be so large and so obvious as to warrant the installation of very complete equipments, consisting of special cranes, several magnets, and a convenient and scientifically arranged collection of bins, shears, etc.

Reference will be made later to the savings effected by railroads in the handling of their scrap material, since this will have a direct bearing on the cost of scrap-handling in foundries. For the present, the following quotation from a paper by F. D. Reed, assistant to the vice president of the Chicago, Rock Island & Pacific railroad, will give a summation of this matter:

Sorting of scrap, the way we handle it here, can be done for from 4 to 7 cents per ton; in other words, we can handle scrap in and out with our facilities for from 10 to 12 cents per ton, including the sorting. Prior to May, 1909, at which time our crane and magnet were installed, when all scrap was handled by hand, the cost per ton in and out ranged from 30 to 35 cents per ton, which is about what it is costing any railroad today that is handling scrap by hand, or even with very good modern facilities for handling, and to keep it down to this figure it must have good and convenient scrap dock arrangements and efficient organization.

The third industry, which would appear to have opportunities to effect savings by the use of magnets, is the foundry. It has been estimated that the foundries of this country melt annually about 6,000,000 tons of pig iron and scrap, and although I have no definite

*Presented at the Pittsburg convention of the American Foundrymen's Association.



MAGNET LIFTING LOCOMOTIVE SADDLE CASTING WEIGHING 4,100 POUNDS

MAGNET OPERATED ON A MONO-RAIL SYSTEM

knowledge of the relative proportions, it would seem reasonable to conclude that of this total about 1,000,000 to 2,000,000 tons is represented by scrap iron and steel.

Of these three named industries in which the lifting magnet can apparently be used to economic advantage, the foundry has been by far the most reluctant to embrace or even to investigate the economies which are apparently open to it. The author trusts it will not be considered presumptuous if he makes the statement that a number of foundries are today not using magnets merely because of an apparent antipathy to departing from established customs and methods.

It is the author's desire to indicate in this paper—fairly and conservatively—the economic possibilities of magnets in foundries, and to outline the costs of installation and of operation of a suitable lifting magnet equipment. This is done with the desire of placing before the foundry manager such figures that he will be enabled to determine what would be his cost of handling by means of a magnet, and assuming that he knows his present cost of handling by hand labor, to enable him to determine, by his own investigation, if the installation of a magnet equipment would be profitable in his individual case.

Cost of Installation and Operation.

An analysis of the costs can be best undertaken from the separate considerations of cost of installation and cost of operation. Later some statements will be made with reference to the severity of service which lifting magnets inevitably encounter, and for the present it is safe to assume that no man, in justice to his company, has the right to purchase any except a well built magnet. A magnet thoroughly capable of withstanding hard abuse costs about $1,300 per ton of lifting capacity of pig iron. Standard magnets are constructed in about four different sizes, and although this figure just named does not hold accurately for all sizes, yet it is a fairly close index to the selling price and is sufficiently accurate for purposes of estimate. It may be mentioned at this point that the approximate lifting capacities of these different sizes of magnets in service are, expressed in pounds of pig iron per lift, as follows: 800, 1,350, 1,950 and 2,400.

Of course some kind of a crane is necessary for handling a magnet, and if the foundry already has its yard equipped with either an overhead traveling crane or a locomotive crane, the installation of the lifting magnet becomes a simple and relatively inexpensive matter. If it be applied to an overhead crane, it is merely necessary to run leads from the crane to the magnet and to provide some simple mechanism for taking up the slack in these leads as the magnet is hoisted. If the magnet be applied to a locomotive crane, current can be furnished to the magnet either by suitable plug stations installed at various points in the yard, or an engine generator set can be put on the crane, the generator delivering current to the magnet and the engine taking steam from the boiler of the locomotive crane. This latter arrangement, while more expensive in first cost, is preferable in that it provides a flexible unit which is operative at any place which the locomotive crane can reach. A high grade, four-wheel, 10-ton locomotive crane, complete with an engine generator outfit, can be installed at an expense of about $5,500, and such a crane will handle a magnet at a boom radius of about 40 feet, thereby covering a large area even if the crane runs on only one track. Of course by the use of parallel spurs a large area can be conveniently, cheaply and completely served by the locomotive crane. A locomotive crane is of such general use to a foundry that it is only fair to charge but a portion of its cost to the magnet. The locomotive crane can, for instance, be used for loading and unloading heavy castings and machinery, and for shunting freight cars. For about $1,000 extra it can be equipped with a two-line outfit and a bucket for unloading sand and coal.

MAGNET HANDLING BALL FOR BREAKING LARGE CASTINGS AT THE BALDWIN LOCOMOTIVE WORKS

If we consider that $3,000 is a proper proportion of the locomotive crane cost to charge against the magnet, and if a magnet is selected of such size that it will have a lifting capacity of about 1,350 pounds of pig iron, the cost of the magnet installation then becomes about $3,900, or, in round figures, $4,000, installed and ready to operate.

Operating Charges.

The operating cost of a magnet consists of certain charges, including operator's wages, fuel and oil, which will exist only when the magnet is in operation, and depreciation charges on the equipment, which will not depart much annually from a fixed amount, whether the tonnage be sufficient to keep the equipment busy practically all the time or only an hour or two a day. It follows then, that the operating cost, which is the sum of these two charges, will necessarily be lower per ton of material handled if the equipment can be kept in service the majority of the time. Most foundries, however, do not melt sufficient metal daily to require the services of the magnet more than two or three hours per day. A concrete case will be selected for the double purpose of indicating how similar estimates may be made to cover any particular foundry, and for pointing out a daily tonnage at which the installation of the magnet and crane appears to be an economic necessity. The assumption will be made that a foundry melts 35 tons of metal daily, 300 days in the year. All of this metal must of course be handled twice, that is it must be unloaded from the car to piles and loaded from the piles to some kind of a wagon on which it is carried to the cupola platform. For a foundry of this capacity the following figures apply:

Charges Per Hour.

Operator's wages	$ .30
Fuel (at $3 per ton and using ½ ton per 10 hours)	.15
Oil, etc.	.03
Total	$ .48

Economies Effected by Magnet.

A crane and a magnet of the size previously referred to, will conservatively handle 35 tons per hour, which will make a cost of 1.4 cents per ton. The annual depreciation on the $4,000 equipment at 12 per cent would be $480, and as 35 tons handled twice per day for 300 days represents 21,000 tons handled annually, the depreciation cost on this tonnage basis is 2.3 cents per ton. This brings the total cost of handling, including wages, fuel, oil and depreciation, up to 3.7 cents per ton. I have been informed that 10 cents per ton is a fair figure to assume for the cost of loading or unloading pig by hand, and on this basis the saving would be $1,323 annually, or 33 per cent on an investment of $4,000.

MAGNET ON LOCOMOTIVE CRANE HANDLING SCRAP

If the case of a larger foundry be cited, melting 100 tons per day for 300 days per year, and assuming in this case that metal is handled more cheaply at 9 cents per ton, by hand labor, the annual saving effected by the use of the magnet is $4,080, or over 100 per cent on the investment. It may be mentioned in the case of the smaller foundry that the time the magnet is in use daily would be about two hours, and in the case of the larger foundry, with the magnet selected, about six hours daily would be required. In this latter instance it would doubtless be more economical to install a magnet having a lifting capacity of about 1,950 pounds, instead of 1,350 pounds, which was the basis on which the estimates were made.

With these figures in mind, attention is directed to this conclusion: A foundry melting 35 tons of metal daily can install both a crane and a magnet, and expect a return upon the investment, after allowing all charges, of more than 30 per cent. If it happens that a foundry is already equipped with either an electric or a locomotive crane, a magnet can then be installed on a very profitable basis when the tonnage to be handled is considerably less. For instance, if an assumption be made that a foundry melts 20 tons daily, and that a magnet be installed on an existing

MAGNET LIFTING A CAST IRON PIPE WEIGHING 4,310 POUNDS

AN ENORMOUS STOCK OF PIG IRON PILED BY A MAGNET

crane, the cost of the magnet being about $900, then the cost of handling per ton, including wages, fuel, oil and depreciation on the magnet, is about 2.3 cents, which would represent a saving in this foundry of about $924 each year, or over 100 per cent on the investment.

Conservative Estimates.

It is very earnestly hoped that these figures be not brushed aside with the assumption that they are theoretical and must be largely discounted. As a matter of fact, the costs of handling by a magnet are stated conservatively, and are being reduced in service daily. The figure of 10 cents per ton for handling pig by hand is an assumption on the speaker's part, but from information gained during six years' experience in the manufacture and sale of lifting magnets, it is believed that this figure is not at all at variance with the facts.

Handling scrap, in general, will be more expensive than handling pig iron, whether it be done by hand or by magnet, but the advantage in favor of the magnet is more marked in the case of scrap than in the case of pig. As previously stated, the railroads have carefully investigated the comparative cost of handling scrap and large castings by means of magnets and by hand labor, and the following information is therefore submitted as being pertinent to the question of scrap handling in foundry yards. N. A. Mears, of the L. S. & M. S. railroad, gives the following comparative figures:

	Cost per ton.
Loading locomotive tires by hand	$0.17
Loading locomotive tires by crane with chains	.08
Loading locomotive tires by crane with magnet	.04
Loading heavy castings by hand—almost impossible.	
Loading heavy castings by crane with chains	.20
Loading heavy castings by crane with magnet	.03

Unloading Scrap.

Another gentleman identified with the railroads states that it costs, for an average of 100 cars, $7 per car to unload scrap by hand, and $2.83 per car to unload the same character of scrap by crane and a magnet. Mr. Reed, of the Chicago, Rock Island & Pacific, says he can unload unsorted scrap with a magnet at from 2 to 5 cents per ton, and sorted scrap at from ½ to 1½ cents per ton. When this work was done by hand labor the expense was about three times as much.

Exclusive of the economies already cited, certain other incidental advantages attend the use of a magnet, and in the summation these would probably be quite great, and any one of them might be very important in some instance. These incidental advantages, somewhat in the order of their importance, may be mentioned as follows:

First.—The elimination of labor trouble, this being particularly true where common laborers are apt to be very unreliable, as in the south, or where the demand for labor for harvesting the crops is extraordinary at certain times of the year, as in the west.

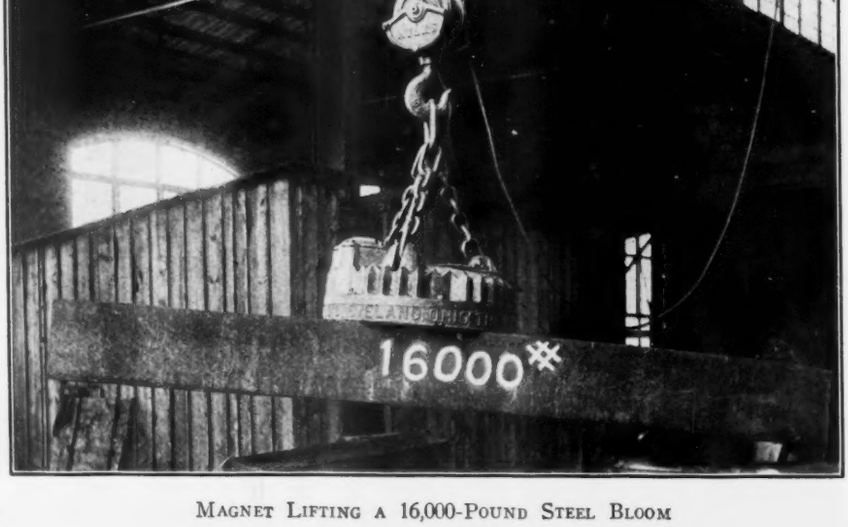
Second.—The ability of a lifting magnet to handle a drop ball for the breaking of castings too large to charge into the cupola. For this application the magnet not only serves to lift and release accurately, the ball, but also to pick up and transport the broken pieces of the casting. For this particular work, not only is the matter of economy to be considered, but also the question of increased safety for the operator.

Third.—The ability of a magnet to unload castings too heavy to handle by hand, and often of such shape as to be very inconveniently handled even by a crane with chains.

Fourth.—The ability to stock pig and scrap in piles higher than would be possible were hand labor employed, and thereby make more efficient use of the available space in the foundry yard.

Fifth. — The ability to unload cars more quickly, and thereby save demurrage.

Sixth.—The recovery of small pieces of iron in the bottom of freight cars, which can be magnetically swept up, but which would be neglected if the cars were unloaded by hand. This fig-



MAGNET LIFTING A 16,000-POUND STEEL BLOOM

ure is considerable in the aggregate, and has been as high as several hundred pounds per car.

Seventh.—The convenient recovery of nails and iron shot in foundry sand. This is accomplished by slowly passing the magnet above the sand and as close to the sand as possible, and as the magnet passes over successive portions of the ground, the small iron and steel particles, mechanically associated with the sand, will break through their confinement and leap to the magnet bottom, where they will be held until the magnet is de-energized.

Eighth. — Independence of weather; this is particularly noticeable in the south, where the negro is temperamentally opposed to cold weather, and where difficulty is sometimes encountered in getting the common laborer to work out of doors during cold and inclement weather. The magnet, if anything, lifts more on a cold day than on a hot one, and will lift pig when covered by snow.

Nature of Service.

Before discussing briefly the design and construction of magnets, it would probably be logical and pertinent to refer to the character of service which they encounter, and particularly to the extremely severe mechanical abuse to which they are subjected. For instance, a magnet, weighing about 1½ tons, is apt to be dropped, each time it is operated, onto a pile of unyielding pig, or scrap, a distance of from 5 to 15 feet. This necessarily means that the magnet is subjected to hammering, and a series of impacts so terrific that it is not comparable with the service given any other piece of electrical apparatus. Magnets are almost always handled by operators utterly ignorant of electrical equipment, and frequently their use has been regarded by laborers with open hostility, because of the fact that the magnets have made many jobs superfluous.

Bearing in mind, then, the extraordinary roughness with which lifting magnets are used, the necessity of sturdy design will be appreciated, and indeed it is true that many of the structural features are merely the response to the demands of hard service, and are, therefore, in the nature of natural evolution of design.

Magnet Construction.

Briefly, the commercial lifting magnet of today consists of a disk-shaped steel casting, having in it an annular recess for the accommodation of the magnet coil, an energizing coil with many thousands of ampere turns to build up a magnetic field, suitable terminals for connecting the coil to the line, chains for the suspension of the magnet, and a non-magnetic bottom to hold the coil in its annular recess, to hermetically seal the bottom of the magnet, and to constitute a shield or a guard for the hammering to which the magnet bottom is subjected. The steel shell must be made of special steel, soft and carefully annealed, so that the magnetic field can be quickly built-up and quickly torn down. This steel shell should be ribbed over its entire external surface, to allow for the rapid dissipation of the heat which is generated in the coil. Coils, in general, are built up of strap copper, insulated by asbestos and mica, and wound on brass or aluminum spools. After the coil is completely assembled, it is thoroughly impregnated at a temperature of about 300 degrees Fahr., giving the coil the best of insulation, and sealing it so as to exclude moisture.

Magnet Control.

An auxiliary device is the magnet control for quickly energizing or de-energizing the coil. For de-energizing the magnet, three different methods have been used: First, merely rupturing the circuit; second, opening the circuit, but allowing a discharge resistance for the inductive kick from the magnet, and third, an actual partial reversal of the current. This last method is the one now employed, and will cause the magnet to release its load several seconds more quickly than by any other known method.

The question of safety is frequently raised, and during the time when the magnet was being commercially introduced, its use was frequently combated on the score that it was dangerous to workmen. Of course, it cannot be denied that if a man is standing under a magnet that is carrying a load, and the circuit is interrupted, something is going to happen to that man. I maintain, however, that it is safer to use a magnet for the transportation of material than it is to use chains, and for several reasons:

First, the magnet is inherently a labor-saving device, and when it is used the number of laborers in its vicinity is reduced, and frequently the magnet entirely displaces ground labor.

Second, a laborer always looks upon a magnet with a high degree of suspicion, since there is nothing tangible to hold up the load, and he avoids getting under a load supported by a magnet more than he would under a load supported by chains; in other words, he uses more caution.

Third, the accidental opening of the magnet circuit probably does not occur as often as the breaking of chains supporting a load.

Molding Machine Practice*

By E. H. Mumford

MOLDING machine practice includes two elements, the practice which the design of the machine involves, and the practice in its use, fitting the machine with patterns, supplying it with sand and disposing of the machine-made molds. In success, as in failure, it is sometimes one and sometimes the other of these elements which is to be held accountable for the result. Molding machine practice occupies a field—the foundry field—where, for many years, so little had been done that almost any mechanism advertised as capable of reducing cost and improving quality of work has found a ready market, especially as so many eager mechanicians have been ready to offer freely for trial, on the no-cure no-pay basis, apparatus, about which their own enthusiasm has too readily become contagious among foundrymen.

It is almost a pity that foundrymen, like railroads, have not an Interstate Commerce Commission to decide for them what is worthy of their notice and what is not. If I were a foundryman I think I would suggest to my artless brethren the reference to a commission as wise in foundry equipment as the Interstate Commerce Commission is in railroad management, foundry machinery of all kinds for its judgment, or opinion, or experience. Such a commission would be as valuable to foundrymen who are now spending large sums on equipment as are consulting chemists or plant engineers.

The advice of such a commission would be as valuable to the sellers of molding machines as to the purchasers thereof, inasmuch as when in its opinion a new machine was worth trying, it would be tried on its

*Abstract of a paper read at the Pittsburg convention of the American Foundrymen's Association.

recommendation in one or more foundries adapted to the use of the machine and willing to make the trial. As to the result of the trial others would be advised, and the parallel selling, and too often parallel failures, rejections and eventual burials of the devices with cost of repeated construction, transportation, foundations and operation would be saved. Probably, at least nine-tenths of the losses involved would be saved to our allied industries.

Similar Experimental Work.

At present this identical kind of experimentation is being carried out independently and often simultaneously by many of our largest corporations, each for its own information. Consider for a moment what it would mean to concentrate in a conference committee or commission such an investigation, what it would mean to the manufacturer of the machine who builds and ships ten for trial when one might answer the purpose, and to the ten independent plants going ten times over exactly the same ground and eventually all ten coming to the same decision.

Such a commission might easily include in its functions the advice of expert patent counsel, exactly as do the railroads, to avoid risk of lawsuit, and most valuable of all, to prevent idle threats of patent suits based on vindictive competition, retarding improvements and intimidating their worthy originators.

Jolt Ramming Machine.

During the past year, as during the previous few years, the most rapid development in molding machine practice has been in large jolt ramming units, bringing into play suddenly and without time for proper consideration, problems of transportation and foundry apparatus without the solution of which these machines cannot do their best. It was recently my experience to sell a machine costing somewhat less than $1,000, where I was party to a conference in which it was decided to appropriate $10,000 to the equipment of cranes, molding floors, runways, flasks, match boards, etc., to properly take care of this single machine.

Had the machine been sold to operate, we will say, under an old-fashioned jib crane, it is doubtful if the installation of the machine would have been considered successful or worth while. With the large investment for facilities mentioned, the machine itself, if it might be considered alone, returned more than its own cost each month and the entire plant paid for itself within a year. These figures, taken from actual recent practice, may serve to illustrate the great advantage of trained and co-operating experts in foundry equipment, such as above advocated, and the advantage of such advice to both the seller and the buyer.

It will need no proof to those who have large jolt-ramming machines installed that there is not a jolt-ramming machine of even medium capacity, worked to even a fair proportion of its possible output in rammed molds, anywhere today. Jolt-ramming machines are in use in which the shoveling of 15 to 20 tons of sand by hand can be practically eliminated by the use of a grab bucket on a crane, and in spite of the fact that two or three of our large foundries are using such a facility, the practice has not been as generally adopted as it would be on intelligent advice from such counsel as proposed.

Machines For Light Work.

There has been no advance in the past 15 or 16 years in the speed of molding machines on bench work per capita. Machines giving large output from single sets of patterns at a labor cost no lower, but often higher, than the simpler machines, have been sold, worn out and abandoned; and such machines continue good sellers and are highly thought of while their use and good health continues. There are instances where exceptionally attentive and able mechanics in charge of foundries today find such machines more profitable than the simpler machines, yet were they to furnish to the ramming and pattern drawing elements of these simpler machines, the same facilities they furnish to the more complicated machine, they would be surprised to find that their improved results were due to their intelligent provision of facilities, rather than to the machines themselves.

The advances in machine-molded bench work have all been in connection with sand supply and mold handling, and it may be worth while to note again that the output of a single hand-power machine may be trebled or even quadrupled by such facilities in any plant where the cost of the facilities is worth while. These great economies are found universally in specialty shops making such castings as air brake parts or pipe fittings and have not yet become so common in ordinary production of duplicate castings as they are destined to become within the next few years.

The net results in good molds being about the same from the many makes of the most efficient machines, the following may be taken as the considerations worthy of the most attention in the selection of these machines for general foundry practice:

First, extent of application.

Second, precision of work.

Third, cheapness of pattern and flask equipment.

Fourth, durability.

The fourth consideration has in it two elements, those of strength and wear. It should be considered that it is especially true of molding machines that the wear of an important function, such as pattern draft, and its deterioration therefrom, should not be aggravated by wear from a grosser function such as ramming. Machines, for instance, which ram and draw on the same guides overwork these guides and incapacitate them for the delicate function of pattern-drawing, while these would still continue serviceable for ramming.

Although this consideration does not strictly belong here, it seems appropriate to direct attention to the fact that it is not good foundry practice, from a mechanical standpoint, to put so rough an element as an old foundry bottom board in the line of pattern draft. When such a board has been sprung by ramming pressure, so that it recovers when the patterns start, this becomes all the more true. That such boards are, by the contrivance of the builders of the machines and the patience of their users, used with moderate success does not prove anything, except that there is much which cannot be expressed in formula or in mechanism which triumphs over mechanical failure otherwise assured to the unintelligent functioning of machinery.

Casting Iron on Steel

By N. W. Shed

Question:—We are experiencing considerable difficulty in casting hubs onto the steel spokes of wheels.

Answer:—The trouble is due to the dirt on the steel spokes. It is essential that the steel be absolutely clean in order that the iron may make a good contact without the formation of blow-holes. The ends of the spokes should be immersed in an acid solution until every particle of scale or rust has been removed. The acid is then washed off and the metal dried. The spokes are then coated by immersing them in melted tin or by applying a coating of silicate of soda. These coatings keep the bars from rusting. When the hot iron strikes the steel, the tin or silicate disappears and the union of steel to iron will be complete. To guard against moisture condensing on the spokes, many foundrymen apply crude oil.

FOUNDRY LAYOUT AND CONSTRUCTION*

A discussion of the problems involved in the arrangement of casting plants--The building, its design, roof, floors, etc.

By G. H. Hooper

IN THE construction of foundries of such tonnages that handling methods must be carefully considered the most important points to be determined, primarily, by the engineers are the characteristics as to weights, shapes, sizes, etc., of the product to be manufactured, the facilities for receiving and storing the raw materials, the shipping of the finished product and the routing of the various materials and processes required in its manufacture.

The location of an industry is usually determined by one or more important factors over which the engineer may have no control but which he must thoroughly analyze, as these factors introduce conditions which should be anticipated early to avoid serious complications when the planning of the equipment and structure are undertaken.

Railroad or dock service, or both rail and water facilities, are, of course, an absolute necessity to the modern manufacturer and the routing of the product with reference to the location of these or the building of additional sidings or spurs to fit plant operating conditions, must be carefully planned.

Arrangement of the Foundry.

After these preliminaries have been duly considered and digested a definite plan of campaign may be mapped out to include such items as the locations of cupolas or furnaces with relation to the cheapest and most convenient method of handling iron, coke or coal for charging and the facilities for taking away the molten metal for pouring and the removal of the attendant refuse and waste. The layout of the molders' benches or machines should be considered with relation to the receiving of molding sand and location of pouring floors, which should in turn be contiguous to the cupolas.

The selection of a section to be devoted to the making, baking and storing of cores must also be assigned, which should be convenient to the molders, as the transporting of this more or less fragile material is a hand labor item which we have not yet been able to very successfully supersede by mechanical methods.

If the foundry has a malleable department, the location of annealing ovens must be selected to minimize the distance of handling between them and the hard and soft cleaning mills, while the storage of packing and the filling and dumping of pots must be arranged to give the greatest service with the least amount of handling.

System For Handling Materials.

Another important item is the early selection of a system for the handling of miscellaneous materials. It will probably develop that some one of the well-known systems, such as hand-operated industrial cars, storage battery or steam locomotive industrial systems or mono-rail transportation systems will be chosen. Generally speaking, I am of the opinion that the overhead mono-rail system, which, in combination with transfer cranes for covering specified areas, makes a remarkably flexible arrangement.

Although it has been pointed out that a crane aisle equal in width to the space occupied by industrial systems must be reserved for the operation of mono-rail systems, it is possible to utilize this space for hand trucking—and a certain amount of hand-trucking and wheelbarrow work is unavoidable in any plant—without interfering with the operation of the traveler. Then, also, the storage space for castings at cleaning mills and chipping and sorting benches, sprue cutters, grinders, etc., may be placed most conveniently to the operators engaged in this work, still allowing the traveler to serve operators beyond these zones without interference.

One factor decidedly favorable to the overhead system is that a plant may be laid out at several different grades to take advantage of material storage facilities, or to avoid expensive cuts and fills, the track level remaining uniform and the difference made up in the length of the cables and the size of the winding drums. The final determination of the selection of this system is dependent, however, upon other factors of more or less importance, such as the size and shape of the plant, the distance between points and the area of the zones over which the material must be transported. and the variety of services to which it can be applied.

Following the selection of the general handling scheme, the individual handling methods may be considered, and, whether they are for molding sand handling and tempering, scale handling and storing or core conveying, each must be given close study and careful consideration as to the amount of floor space it is to occupy and the elevations of its various levels.

The number, size and characteristics of the cleaning mills and their attendant exhaust systems is a feature which may require some analysis before their location may be assigned, as will also the space required for the storage of flasks, bottom boards, spare parts, etc., and the lining and drying of ladles.

Should apparatus be installed for the reclaiming of iron from furnace slag and foundry waste, a space must be set apart for the storage of the slag and the disposal of the refuse resulting from this process. If a department for the generation of electric power is required the site may be selected by the usual rules applicable to industrial power plants. These rules hold good up to the selection of the current characteristics which should, for foundry work, be alternating, as the machinery operated in a foundry is almost invariably located in a dusty and sometimes, inaccessible location. Heavy motors of the induction type should be used, as these are less susceptible to abuse and neglect than other types.

Electric Power For Cranes.

Current for operating cranes, which, for the nice control required for pouring small molds from large ladles should be direct, may be obtained by providing an exciter of sufficient size to supply the required amount of current, if current is being generated locally, or from a motor generator set, if current is being purchased from a central station company.

The incorporation of these zones into the general scheme must be such as to give the greatest economic bearing, one on the other, relative to a direct and systematic routing of the product.

This outline gives in a general way a working basis, but even this must be flexible enough to vary somewhat as the detail design progresses, although when the selection of a scheme has once been decided upon

*Presented at the Pittsburg convention of the American Foundrymen's Association.

by careful consideration of each factor independently and collectively, no radical departure should be entertained, as this leads to the destruction of the entire layout.

Careful consideration in the selection and assignment of these various processes and the apparatus required by them are imperative in a foundry, as casting production is one of the least flexible of the manufacturing operations, particularly if it be of the high grade malleable type with large furnaces and ovens set on massive foundations and provided with self-supporting stacks a hundred or more feet in height.

Design of the Buildings.

Thorough preliminary work also tends to cheapen the cost of the buildings, as after the apparatus has been located, short roof spans may be adopted in certain cases when building columns can be placed so as not to interfere with the equipment or operations. Conversely, large spans and heavy trusses may be used to avoid placing building columns in such positions as might increase the cost of the equipment and interfere with production. Although, at times, this adds materially to the cost of the building structure, it is chargeable only to the amortization account, while a row of columns, which interfere with the handling of materials or which sever the continuity of the product, would set up and maintain a perpetual charge against the cost of production.

Portions of the building over some types of apparatus, such as conveyors and high bucket elevators, for instance, can be specially treated, leaving the rest of the building more or less standard, where, if the designing of the building is allowed to proceed regardless of special equipment problems, a large part of the building may have to be treated expensively so as not to interfere with the special apparatus when these are finally decided upon.

Although I have not attempted to give a detailed description of the machinery usually installed in a mechanical foundry, I think I have outlined enough to show that its application makes necessary, extensive and fundamental changes in the type of building required for housing this industry.

Height of Foundry Buildings.

In place of the single story building with crane or cranes carried on columns or on side walls, with a light steel or wooden truss sufficient only to carry a roof of comparatively light construction, we have a building of heavy and modern steel design capable of sustaining machinery loads of considerable weight, and of absorbing the vibratory stresses and shocks imposed by this equipment. In cases where the product can be routed more economically by the adoption of multi-storied buildings, foundries of two or more stories are becoming common.

This type of construction is also being adopted where land values are high and in cases where extensions are necessary to existing plants that are cramped for ground room. Although the adoption of modern construction entails a considerable amount of study and preparation, and adds somewhat to the cost of construction, this has been proven to be fully compensated for by the results obtained.

Preferably, in my experience, the structure takes the form of a steel skeleton with curtain walls and masonry pilasters, concrete floors, metal sash windows in some cases, heavy steel trusses supporting a roof of one of the acceptable forms of concrete tile now available.

For finishing and shipping departments on the ground floor of foundry buildings, a tar-concrete base carrying a Georgia pine rough floor with a finish floor of factory maple or beech, has given satisfaction, while concrete floors present a good working surface for most operations. In some cases, however, it becomes necessary to select special flooring to meet severe conditions.

Foundry Floors.

For malleable foundries using mechanical charging trucks, operated either by steam or compressed air, a flooring material embodying a wearing surface sufficiently tough to withstand the tractive effect of the driving wheels, as well as the necessary strength to carry the heavy loads transported by these machines, is required. The hardest material succumbs rapidly to the slip of the driving wheels and where steel plates have been used to protect the finished surface of the concrete, they have been found to buckle badly.

Wooden paving blocks seem to offer, so far, the only solution, and these, I can say from my own experience, make a very satisfactory flooring for this srvice. The expensive creosoted block, such as is used for street paving, is not required in foundry work, however, as a much cheaper type of block can be used which gives equally as good results. This floor can be laid up to within a couple of feet of the oven fronts, a good quality of vitrified paving brick being used to bridge the space between the refractory floor of the ovens and the block floor outside. For a one-story building devoted to floor molding, no floor other than the suitable sand floor with pits is necessary.

Building Walls.

The building walls are preferably of brick and the columns supporting craneway and roof trusses should be built and well-fitted into the masonry to save the expense of repainting. The roof trusses, and this should apply to all forms of buildings, whether single or multi-storied, should be constructed with heavy, single web members to facilitate cleaning and painting; and the construction of these trusses should be such that all parts can be reached easily for these purposes.

The purlins require considerable care in aligning them to support the tile roofing, but this can be done quite easily with sag rods, even when the purlins cover spans up to 18 feet. Several excellent types of cement tile roof are now on the market and these have some decided advantages over most other roofing materials for foundry purposes. The principal reasons for adopting this roof for industrial purposes are that it combines strength and lightness and that it is practically indestructible from natural causes, thereby tending to make the cost of maintenance exceptionally low.

Foundry Roofing.

A novelty embodied in this form of roofing is the glass inset tile, which appeals strongly to the foundry manager or engineer. It being a well-known fact that the molding department is particularly hard to illuminate artificially owing to the natural tendency of the dead black surface of the molding sand to absorb the light rays, the use of the glass inset tile makes possible natural, overhead lighting, which extends the daylight period considerably without the use of monitors or heavy metal frame skylights, both of which embody some very disagreeable features. As it has been proven by the practice of other engineers as well as myself, that the inset tile is a more efficient lighting medium than the side-lighted monitor, we may as well dispense with this awkward and inartistic structure entirely and substitute for its ventilating features the hooded copper ventilator, several makes of which are so constructed as to induce a draft when a slight breeze is blowing from any direction.

Before the design of the steelwork can be submitted to the contractor for

estimates, the location of the machinery carried by the steelwork must be decided on and the weights, shocks, etc., determined. It is usually found that certain portions of the steel structure will be free from special loading and these can be ordered and fabricated while the special work is being designed. As soon as these features are determined, the contractor for the foundation work can be notified to complete this part of the work first, thus keeping ahead of the steel workers, who, in time, make way for the bricklayers or the concrete form builders.

As soon as the steel work is completed in the special sections, the active work of erecting the conveying and other machinery may be started, orders having been placed for the purchase of this equipment while the design of the building and steelwork was going on, the general contractor having in the meantime been supplied with information for the location and building of the machinery foundations, trenches, special floors, etc. The roofing to be applied as fast as the trusses and purlins are placed and riveted.

Heating the Foundry.

When a foundry plant is under one roof and covers a considerable area, the method of heating becomes a good deal of a problem, as certain zones must be heated to obtain the best results in the cleaning and sorting rooms when these departments are located at some distance from sources of waste heat, such as cupolas, ovens, etc. Some heat is also necessary at night to avoid freezing between the hours when the castings have been shaken out and cooled and before the fires are started in the morning. In buildings not over 50 feet wide, direct radiation placed on the outside walls should be adopted, but in the wide buildings covering a large area it is obvious that this system cannot be used. For positively supplying heat to certain stipulated portions of a building of this type, the hot blast heating system seems to give the desired results so far as the actual raising of the temperature is concerned.

Artificial Illumination.

I have touched lightly on the subject of illumination under the head of roofing and monitors. For general illumination of pouring floors, rough and finished storage and shipping departments, I have had very good success with the mercury arc lamp, although, in some cases, the 70 or 100-hour flaming arc has given better results. The field of usefulness of the 16 candlepower incandescent lamp is, however, but slightly encroached upon by the large unit lamp in foundry practice, as I have found it necessary to provide for each molder, and over each unit of machinery, as well as at all benches, at least one small unit lamp in addition to furnishing a row of incandescent lamps spaced at proper intervals along the lines of conveyors. The liberal use of plug receptacles placed handy to all machines and all trenches and inaccessible places, is strongly advised, so that portable lamps may be attached by extension cords for the examination of and repairs to apparatus.

Athough there is a large and increasing demand for the tungsten and metalized filament lamp I am not yet convinced that these lamps are sufficiently rugged to withstand the treatment which lamps in a foundry receive. The excessive breakage of the entire lamp in some cases, and the destruction of the filament in others, coupled with the high first cost of these units, far exceeds the saving obtained by the lower current consumption of the high efficiency lamps.

Plumbing.

Under the head of plumbing are included the questions of water supply, toilets, wash rooms, drinking fountains, etc., and in this connection the problem of sewage disposal must be treated. The subject of providing toilets for the rank and file of foundry employes is one of the most vexing problems for the engineer to solve. Although I think these men do not maliciously smash doors and closet seats and rip chain pulls from their fastenings, they apparently become, through the labor that they are called upon to perform, what might be described for the want of a better term to describe their subconscious movements, *heavy-handed,* which condition acts disastrously on even the heaviest plumbing fixtures known to the trade. The lifting closet seat is, of course, a decidedly unsanitary adjunct to the toilet room and the heavy, roll-rim, seatless closet is far more desirable from this point of view. The seat, however, has its advantage in that it can be used to operate the water for flushing the closet.

One of the most successful ways of solving all of the toilet room problems consists in detailing an employe to see that the closets are kept flushed and cleaned and that no loafing takes place around them. This method has its drawbacks in foundries covering a large area, however, as it is necessary, in this case, to scatter the toilets and divide them into small units so that the men cannot have any excuse for straying away from the work on which they are engaged, as would be the case where one central location for toilets is provided. I am fully convinced, in view of these facts, that if toilets are to be provided for the more ignorant class of labor, they must be kept under the constant surveillance of some responsible employe or they become a continual source of expense and dissatisfaction.

Water Supply.

The water supply for a foundry should be selected after considering the following factors:

Cost and quantity guaranteed by municipal or private water companies.

Availability of natural supplies.

Cost of utilizing this supply.

Quantity and quality obtained from natural sources.

Decision on this point is necessary before the water supply system can be laid out, which includes piping, pumps, tanks, tower, hydrants, hose houses, etc.

After some experimenting with fancy fixtures, and a great deal of consideration based on the opinion of foundry superintendents and my own observation, I have concluded that a plain, copper-lined wash sink, provided with hand basins clained in place and supplied with hot and cold water, is the best method for washing, both from a cost and sanitary standpoint. Shower baths seem to meet with an equal amount of favor and disfavor by the foundry managers. Personally, I am in favor of installing them, as they not only increase the efficiency of the men in warm weather, but they also increase the self-respect of the men who use them.

Pattern Shop.

The departments tat it is advisable to detach from the main buildings are the pattern shop, the equipment machine shop, the structure covering the oil storage tanks, if these are used, and if power is being purchased, a building housing the high tension switching apparatus and transformers. By making the pattern shop an independent structure, we are able to erect a building having light on all four sides and of a width which insures light at the machines, the best practice being to place these between the center aisle and the benches, which are, of course, located adjacent to the windows. The pattern stock room may be located either above or below the manufacturing floor. If above, the lumber may be raised by a plain hoist, large doors opening down to the floor being provided.

A very good arrangement is obtained by the combination of the equipment machine shop and the pattern shop under one roof. The build-

ing may then be of the multi-storied type, devoting the basement to the storage of heavy equipment materials such as sprockets, heavy chains, pulleys, shafting hangers, motors, etc.

The first or ground floor is, in this case, the logical location for the equipment machine shop, which contains such machine tools as are necessary in the manufacture of flasks, metal patterns, core boxes, etc., consisting of lathes, planers, shapers, saws, drills of various kinds and such other tools as may be required to meet the demands of the foundry. Space should be allotted in this department for a complete repair shop and the headquarters of the various repair gangs. These are usually divided into millwrights, steam fitters, plumbers, and electricians. Each of these gangs should be assigned sufficient space for benches and lockers and the storage of chain blocks, rope-falls, etc.

An erecting space should be reserved on this floor for the setting-up and repairing of large machines, charging trucks, etc., which are more conveniently repaired in the machine shop than in the works.

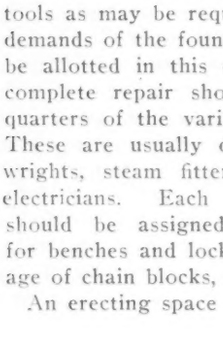
Frequently, not enough attention is given to the repair departments at the inception of an industry, although the maintenance of a plant is given prominent recognition in the estimated production costs. A properly equipped and organized maintenance force can be made to show savings where production departments show earnings, and just as much care should be expended in the incorporation of this department in the general scheme, as that of the molding floors or the power house.

Assuming that the basement and first floors of the combination building are occupied by the equipment machine departments, the pattern manufacturing department should be assigned to the second floor and as many floors added above this as are required for the storage of patterns, pattern stock, etc. This building should be of fireproof construction throughout and should meet all underwriters' requirements as to automatic doors, sash, etc. The floors should be connected by an isolated fireproof stair case served by a platform freight elevator.

In conclusion I would like to add that I have endeavored to emphasize the fact that the construction of a foundry, as is the case with all industrial plants, begins with the selection of the site and every factor embodied in this decision has a certain definite and important bearing on the physical planning of the industry. The actual design and construction of the buildings are entirely controlled by this and the modifying conditions attendant upon the production of the commodity manufactured.

A View of the Foundry at Close Range*

By B. D. Fuller



WE, who follow the foundry industry as a means of livelihood, must ever be thankful for the existence of the American Foundrymen's Association, as it has undoubtedly been a great source of useful education, and information and has accomplished much towards foundry advancement. We are accustomed to listen to learned technical discussions, and do not question their worth. But there are many among us who understand terms such as *air blast, coke, fire clay,* etc., who are more or less lost when discussion of the same subject is couched in such terms as *carbon dioxides, monoxides, calcium, alumina,* etc. For such as these a talk on the every-day, common-place subjects connected with the shop may not be considered out of place. Foundrymen (and I am one of them), whose pleasure it is to religiously visit the cleaning room bright and early each morning and seeing a casting with the sand dropping away from it, leaving a clean, smooth surface, cores falling away with little labor, no fins, scabs, or buckles—a job which speaks of good, mechanical, heady work—feel a thrill of pleasure as of an artist when gazing upon a masterpiece, and on the contrary, feel disgust and disappointment upon finding a casting with sand burned-on, cores hard, or surface showing scab or swell.

What can the *man behind* do towards being of assistance in accomplishing the desired end—good castings at reasonable cost?

Sand Problem.

When the problem consists of a shop full of work of a more or less intricate character, with good molders scarce, and a class of men to rely upon, the majority of whom are unskilled, there are many things to be considered, not the least of which is the sand. There is nothing in connection with the foundry more worthy of careful study, and constant watching, than sand. I am not going to pose as an authority on sand specification by analysis, but where men are working a sand, not suitable on account of being too close to stand hard ramming with a minimum use of the vent wire, coke bed, or other means of carrying away gases; or the other extreme, a sand too sharp and lacking in bond, contributing towards loss through wash, or drop-out, I will guarantee that, given the same men, sand properly mixed and tempered and of a nature to stand ramming, containing bond enough to stand up well in pockets or overhanging projections in the mold or core, and at the same time vent freely, you will find a very marked improvement in quality, as well as decrease in cost of product. Time devoted to ascertaining the proportions of new and old sand in facing and core mixtures, to seeing that mixing machines are properly operated, that the right proportion of binding material and no more is used, is well spent.

Establish your system and see that it is lived up to, and not changed without a good reason and with your consent, and a substantial saving in material plus better product is bound to result.

You may say: "We are mixing core sand 1 to 60." Do you know this to be true? Have you taken time to work out the proportion and provide means of measuring and mixing, about which there can be no guesswork?

Again, when large cores are made in quantities, the use of cast arbors, as a means of safety and economy, is generally overlooked. When you have a stock of arbor patterns, it more often means but a slight change to adapt an old pattern to a new job. Suppose it does require one or two men to mold these open sand arbors every day. The cast arbor will save days of time in cutting and shaping wrought iron or steel rods, will give a firmer and more stable core, and enable the coremaker to use fine coke or venting material, where he otherwise could not make use of it, which all means that a good core can be produced by a man whom you would not consider the best mechanic.

*Presented at the Pittsburg convention of the American Foundrymen's Association.

By being enabled to produce good work, such a man soon gains confidence in himself and goes after things in such a manner that before long your painstaking, careful mechanic is left behind in amount of work produced, for he will not *take a chance*, as he is apt to term the breaking away from his *slow but sure* method.

Rope Slings.

It may, on first sight, look like extravagance to allow rope slings to be used in a shop on core and molding floors where chain or iron beam and sling could be used. But when we figure the gain in time, due to the speed of adjusting a rope which adapts itself to all shapes, I believe, in many cases, it is an actual economy to use them. Also, we can see when a rope has outlived its usefulness, as it will give warning, where a chain will snap unexpectedly, often causing accidents which are an everlasting regret.

The practice of drying molds may be carried to an extent which may seem an extravagance at first sight. What I mean is, to walk into a shop and see right and left the burning of charcoal in pans suspended in molds or charcoal in a mass upon a sheet of corrugated iron covering a mold. Here again may be an economy, in that men who would require years of careful training to make thorough green sand molders, can, in a comparatively short time, be taught to do good work through dry sand methods. The mold can be rammed harder. It requires less venting, and when wet-blacked and slicked, gone over with a final plumbago wash, will give surer results, provided the facing sand is right.

Gas for Mold-Drying.

Where gas is obtainable, this is one of the best agents we have for mold-drying, as burners may be formed for jobs which are in day after day, and *stunts*, such as drying drag cheek and cope of the same mold at the same time with the one burner can be carried out, thus saving time, money and space.

Most of us know of the stopper brick used in the bottom of the steel foundry ladle. Brick of this general design with ½-inch wall with hole 1, 1½, 1¾, 2 and 2½ inches in diameter, will be found very handy and economical when used in making pouring gates and runners on heavy work. They are generally made in sections, 6 inches long, fitting one into the other, can be laid in the mold in any direction, like laying sewer crock. They will not blow or swell, and when rammed in, cannot burst. The cost is reasonable and the economy in use quite considerable; again, they are one of the means to an end, cutting down the risks and helping the output.

Molding Pits.

As a further safeguard, the pits in which large castings are made, time after time, should be carefully arranged to minimize risk. Binders should be placed across the bottom, heavy cast iron plates on these binders and curbing at least part way up the walls. Proper means should be provided for adjusting bolts from bottom binders to cope, etc. All these are well known safeguards, but when applied, make the daily work much easier, and save many a casting.

On this class of work a pneumatic rammer in the hands of the molder's helper makes him about as valuable as the molder himself, at least while the ramming is going on, for the outside or back ramming can be done as well by the helper with the air rammer, especially when under the molder's eye.

Pattern Shop.

That indispensable adjunct of the foundry—the pattern shop—is a veritable gold mine, passed over by many a prospector, *having eyes, yet seeing not*. Yet here lies hidden a well nigh inexhaustible fund of help worth much time and study. First consider, we must depend upon the pattern shop fully as much as the foundry for the success of the molding machine, and here let me say, that the molding machine is first of importance on my list of appliances necessary to success. This is too broad a subject to be covered in this paper, but to emphasize the above statement, I will mention the fact that the Westinghouse Electric & Mfg. Co. has in its iron and brass foundries, upwards of 600 machines in operation.

The more simple the machine, the better the results, as a general statement. I am sometimes lost in trying to figure out what would be the result were we compelled to turn out our foundry product entirely by old, hand methods. As yet, the field for advancement in this line is great, especially is this true of the large jar-ramming type for heavy work, with its adjuncts, the grab bucket for handling sand, and the pattern-drawing device used independently of the machine.

Patterns for Machine-Molding.

Construct patterns for the molding machine direct from the drawings where at all feasible, for not only do we save the cost of original patterns, but save money on every casting *right from the jump*. Small castings made by hand from loose patterns cannot be compared, as to quality or cost, with those made upon molding machines from proper patterns.

As within the scope of this article, I wish to say something of patterns other than those for the molding machine. Second only to the machine in importance is the match-plate system, meaning by this not simply plates with one-half pattern on each side to ram cope and drag upon the same plate, but parts on separate boards, or plates, and as is true of the machine, the more intricate the design, the more they are worth.

In some cases, as many as four separate plate patterns for a four-part mold are being used, and these are patterns up to 8 feet long, and even larger, from which castings are produced. Here again, the man not considered the finest mechanic will produce good work. He cannot abuse the pattern by beating it with a hammer, as he cannot reach it. The gates are formed as part of the pattern, thus doing away with a source of much loss and trouble, for many a job is spoiled in the cutting of the gate.

Pattern-Drawing Device.

As a general thing, these match plates can be drawn from the mold by means of the simple guide pins in the flask, leaving a perfect mold, but when the draw is too intricate for this method to be successful, a simple drawing-device can be applied by hand to the match-plate after the mold has been rammed and rolled, which will give a perfect mechanical draw, leaving the same as fine as any machine-made mold.

Suppose we wish to make a casting of the shape of an oil or molasses barrel, to be cast on end. The usual procedure would be to make the pattern in two parts divided in the center at the greatest circumference, thus necessitating a deep cope, or in case the pattern is large, 8 to 12 feet in diameter for instance, we would bed it in the floor, make a slanting parting down to the center, or dividing line, and use lifting plates. We part again at the top line, lift plates from the center with the cope, draw both parts of the pattern, replace cope, release bolts to lifting plates, lift cope and finish the mold.

Novel Molding Method.

Good results can be obtained by this method, but suppose we make the center or core of this pattern, to resemble a section of water pipe, build on the outside in staves, fastening staves by eye bolts through the center pipe, cover the upper end of the pipe with a lid, ram up simply a two-part mold, lift the cope, remove the lid of the pattern, unscrew the eye bolts, draw out the center and draw in the staves; the result is a perfect mold, made in much less time, doing away with center parting, much lifting, etc. Can you guess how much this means in a shop where patterns of this style are numerous?

The cupola, cleaning department, yard labor, accounting and cost departments, are all subjects calling for time and study, not to be covered in the limits of this article. But I cannot close without a good word for the efficient office man as a valuable assistant. Daily reports are looked upon by many as *red tape*. On the contrary, they are of great value in enabling one to locate trouble and to appreciate things of worth. It is a nice thing to be able, from reports before you on, say the 15th of the month, to calculate in a minute's time, within a small fraction of a penny per pound what your castings will cost at the end of the same month. Such records are not difficult to obtain, nor is the system intricate. I have seen results obtained in shops without any modern equipment to speak of which command admiration. I have in mind, in the city of Buffalo, a shop presided over by an unpretentious man, but a man who knows his shop, and who knows his men.

We often hear it said that "to be a success as a salesman, one must be a mixer," and this is true of the foundryman. He must be a mixer, not in the generally accepted sense of the term, but a mixer who can, at the same time, command the respect and confidence of those under his supervision.

The Equipment of Air Furnaces Using Oil as Fuel*

By W. N. Best

MANY attempts to burn liquid fuel in air furnaces have failed because of the operator not being able to melt the full charge or to get the metal as hot as when burning coal. Often the charge was oxidized to such an extent that what metal did become molten was practically worthless. Usually, a number of burners, each giving a round flame, have been placed in the side wall of the furnace, and as the number of burners was increased, the equipment became more and more intricate. Something had to take the blame for the wasted time, material and effort, so oil was condemned as being unworthy of further consideration.

Advantages of Fuel Oil Melting.

Let us consider the ultimate analysis of the average gas coal used in air furnaces and fuel oil. This coal contains 70 to 75 per cent carbon, 4.5 to 6 per cent hydrogen, 10 to 18 per cent oxygen, 1 to 2 per cent nitrogen, and 0.5 to 1.5 sulphur. The calorific value is from 13,500 to 15,300 British thermal units per pound.

The analysis of residium or fuel oil follows: Carbon, 84.35 per cent; hydrogen, 11.33 per cent; oyygen, 2.82 per cent; nitrogen, 0.60 per cent, and sulphur, 0.90 per cent.

The weight per gallon is 7.3 pounds and the calorific value ranges from 18,350 to 19,342 British thermal units per pound.

From this data, the natural conclusion is that oil, having a much higher calorific value than coal, should be able to melt the metal in a much shorter period than coal. Not only that, but it should also be able to bring the metal to the temperature required for even the smallest castings. It can do both if properly applied, and furthermore, the quality of the metal is improved, for by chemical analysis and numerous tests, it has been found that the castings contain no more sulphur than the metal did when charged into the furnace, and the tensile strength is consequently greater than of metal melted by coal fire. As the melter has the furnace under perfect control, the heats can be taken off much quicker than when burning coal, and the temperature of the charge, while being tapped, can be maintained without varying more than 25 degrees Fahr., until the entire charge has been run from the furnace. The operation of skimming is materially decreased, a very noticeable improvement which is especially appreciated by the melter. The high calorific value of oil also enables the melter to estimate within a few minutes as to the exact time when the charge will be ready to tap, which is in striking contrast to conditions while burning coal, especially in rainy weather, when climatic conditions are unfavorable and the stack draft is materially affected.

Changing From Coal to Oil.

The change from coal to oil is a very simple matter. In the original firebox is constructed a combustion chamber of such form and proportions that the air necessary for perfect combustion can unite with the atomized fuel before it reaches the furnace, which prevents oxidization of the charge. Also, this chamber causes the heat to be deflected upon the entire surface of the bath. In the end of this combustion chamber is placed a hydro-carbon burner of peculiar form, which makes a fan-shape blaze, filling the entire chamber with flame. This burner exteriorly atomizes any gravity of liquid fuel which will flow through a ½-inch pipe, such as fuel oil, crude oil and tar. Its construction is such that it cannot carbonize, and there are no parts to wear away or get out of order. A very small quantity of compressed air is used through the burner to atomize the fuel and distribute the heat, while the balance of the air necessary for perfect combustion is supplied at from three to six-ounce pressure, through a volume air nozzle.

Economies of Oil Melting.

The furnace is charged in the usual manner. The burner is started by opening the air valve, holding a piece of burning waste, which has been well saturated with kerosene, by means of a pair of pick-up tongs under the burner and then turning on the oil. This burner is very simple to operate. In fact, it is so very simple that one must see it in operation to appreciate that as intense a heat can be obtained with it in a few minutes as from burning coal for several hours.

The reduction in the time required to get the charge ready for tapping is not the only point wherein oil is more economical than coal. There is no handling of fuel and ashes, consequently the services of the fireman and coal passers are dispensed with. There is great saving in floor space, for the oil tank is placed underground and the former coal bins are used for other purposes. The fire brick lining of the furnace lasts 20 per cent longer than with coal. Poor or imperfect castings caused by the metal being cold or sluggish, are obviated entirely, for with liquid fuel, the question is not how hot you can make the metal, but how hot do you wish it? All these items should be taken into consideration

*Presented at the Pittsburg convention of the American Foundrymen's Association.

THE FOUNDRY DATA SHEET, JUNE, 1911

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication.

FORMULAS FOR FINDING THE WEIGHTS OF IRON CASTINGS.

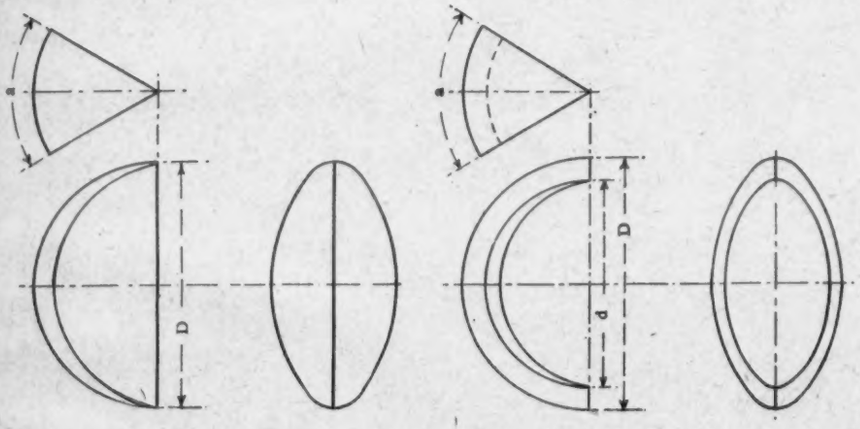
By W. L. Tryon.

To find the weight of a spherical wedge, multiply the diameter of the sphere cubed by the number of degrees in the angle by 0.000379.

$$W = D^3 a \times 0.000379.$$

To find the weight of a hollow spherical wedge, multiply the difference between the outside diameter cubed and the inside diameter cubed by the number of degrees in the angle by 0.000379.

$$W = (D^3 - d^3)\ a \times 0.000379$$



W = weight of casting in pounds.
D = outside diameter of sphere in inches.
d = inside diameter of hollow sphere in inches.
a = number of degrees in the angle.

Data Sheet No. 91, The Foundry, June, 1911.

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

FORMULAS FOR FINDING THE WEIGHTS OF IRON CASTINGS.

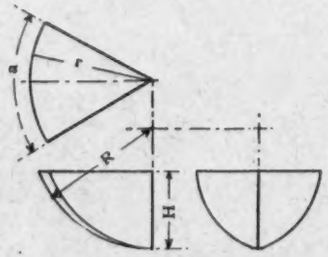
By W. L. Tryon

To find the weight of a sector of a spherical segment of one base, multiply the difference between the radius of the sphere and one-third of the height by the height squared by the number of degrees in the angle by 0.00227, or to the radius of the base squared multiplied by the height by the number of degrees in the angle by 0.00114, add the height cubed multiplied by the number of degrees by 0.000379.

$$W = \left(R - \frac{H}{3}\right)\ H^2 a \times 0.00227$$

or

$$W = r^2 H a \times 0.00114 + H^3 a \times 0.000379.$$

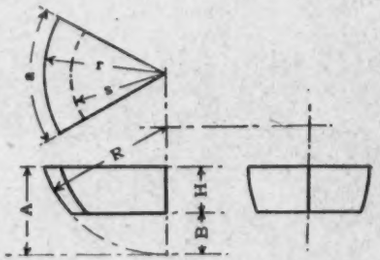


To find the weight of a sector of a spherical segment of two bases, from the difference between the squares of the distances from the bases to the pole multiplied by the radius of the sphere by the number of degrees in the angle by 0.00227, subtract the difference between the cubes of the distances from the bases to the pole multiplied by the number of degrees by 0.000757, or to the sum of the squares of the radii of the bases multiplied by the height by the number of degrees in the angle by 0.00114, add the height cubed multiplied by the number of degrees by 0.000379.

$$W = (A^2 - B^2)\ Ra \times 0.00227 - (A^3 - B^3)a \times 0.000757$$

or

$$W = (r^2 + s^2)\ Ha \times 0.00114 + H^3 a \times 0.000379.$$



W = weight of casting in pounds.
R = radius of sphere in inches.
r = radius of large base of segment in inches.
s = radius of small base of segment in inches.
A = distance from large base to pole in inches.
B = distance from small base to pole in inches.
H = Height of segment in inches.
a = number of degrees in the angle.

Data Sheet No. 92, The Foundry, June, 1911.

when comparing the relative costs of using oil and coal in air furnaces.

Strange to relate, the first air furnace which I ever tried to equip with my oil burning system is located on the site where the first malleable iron was made in the United States, by Seth Boyden. The plant is now known as the Barlow Foundry Co., and is located at Newark, N. J. Mr. Barlow, president of this concern, had tried, on several previous occasions, to burn oil in his air furnace, but was not wholly discouraged because of his repeated failures and when a friend suggested that he let the author equip his furnace, he was willing to give oil another trial. A combustion chamber was built in the original firebox of his furnace on a Saturday afternoon more than a year and a half ago. On the following Monday the first heat was tapped out in the usual manner and up to the present time the oil has never failed.

Several months ago, Geo. H. Graham, secretary and treasurer of the Oriskany Malleable Iron Co., Oriskany, N. Y., visited the Barlow Malleable Iron Works and was so impressed with what he saw there that he has equipped his air furnace with oil burners.

For melting semi-steel, the oil-fired furnace can be used to advantage. The steel and pig iron can be melted in this furnace and can either be run into castings or into pigs to be used in the cupola whenever desired. When metal is melted in a cupola, it absorbs the sulphur contained in the coke, but in an oil-fired furnace of proper construction, the sulphur contained in the fuel is absorbed in the combustion chamber before it reaches the bath of the furnace.

Sulphur in Copper and Lead Alloys

EXPERIENCE has proved that the most suitable alloys for bearings are those containing lead in percentages as high as is consistent with their ability to carry the required loads. Copper and lead, however, will only alloy to a limited extent, compared with copper and tin, or copper and zinc. Therefore, it is not possible to make an alloy of copper and lead alone, that will contain sufficient of the latter metal to make it of any value for use as a bearing. In all such alloys some third ingredient is necessarily added to retain the lead in a mechanical mixture with the copper and also to harden the combination, so that it will sustain loads without crushing. For this purpose tin, sulphur and manganese have been found the best.

Of these three elements, tin and sulphur are the most efficient in forming solid solutions of lead in copper, but the retention of lead by means of tin is limited and bears a close relation to the percentage of tin in the alloy. Owing to this fact it is not possible to obtain as wide a range of lead percentages in alloys containing tin as can be produced by the use of sulphur, as the latter element possesses the property of retaining lead, and by its means admixtures of copper and lead can be obtained in almost any proportion when the two metals are alone, and through wide limits when other metals are present. The efficiency of a third ingredient in retaining lead in copper is in proportion to its capacity to produce a porous condition of the copper, or of the alloy which it may form with the copper, as it is in the interstices of this porous mass the lead is held like the water in a sponge.

Sulphur.

Tin produces a maximum condition of porosity, when alloyed with copper in the presence of lead to the extent of 5 per cent, and the spongy matrix thus produced will absorb up to 30 per cent of lead, but any increase in this percentage of tin diminishes the porous area, and lessens the amount of lead the alloy will retain. Sulphur, however, produces this spongy condition irrespective of the presence of lead. The addition of 1.25 per cent of sulphur to copper, produces castings that sink in the head and bear every external indication of being perfectly solid, but which are porous under the skin. The influence of sulphur in this respect, while somewhat modified by the presence of other metals, is not eliminated, and such combinations as copper 56 per cent, lead 40 per cent, and iron 4 per cent are easily made by its use, and produce fair castings, while without sulphur such a combination would be impossible.

Bearing alloys containing high percentages of lead can be also hardened by the use of antimony in place of tin, under the influence of sulphur, and numerous other combinations can be effected. Although many of these alloys have been investigated, none was found that, in all respects, is the equal of the copper, tin and lead alloys. While sulphur will produce a condition of porosity in copper very similar to that developed by oxygen, there is a distinction between the two, as copper containing an excess of oxygen expands when poured into sand castings, so that the metal flows back out of the head, and the castings are often distorted. In the experiments with sulphur the copper did not act in this manner, but, as stated, the heads settled down, and in appearance, the castings were solid. It seems peculiar that while both oxygen and sulphur cause porosity in copper, the one should produce a condition favorable to the absorption of lead, while the other is distinctly unfavorable to such an admixture, and must be reduced as much as possible, or entirely eliminated when producing such alloys. This difference is in all probability due to the fact that the pores in the metal produced by oxygen are filled with gases under pressure.

The sulphurization of copper and lead alloys by the direct addition of sulphur does not produce as satisfactory results as are obtained when this element is introduced by means of some of its compounds. The addition of iron to such alloys can be made by means of the sulphate or the sulphide of iron, the latter being easily prepared by first placing the iron in a crucible, and, when it reaches a red heat, adding the sulphur, after which the copper can be charged. There are numerous ways of adding sulphur that will suggest themselves, and as the manner in which it is added makes a considerable difference in the alloy, it will often pay to experiment in order to determine which is the better way. The end sought is the production of an alloy whose fracture shall possess a dense, uniform, light gray color, free from defective areas characterized by red blotches.

The manner in which the sulphur is added, the quantity used, and what fluxes are used with it, all contribute toward the excellence of the product, and while these points have not, as far as is known, been definitely ascertained, investigation has shown that every effort should be made to retain the lead, by the use of the minimum amount of sulphur, and to so flux the metal that the slag will be fluid, and not in the form of lumpy masses of dross.

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Contents

Report of the Proceedings of the Foundrymen's Convention at Pittsburg 147
Lifting Magnets for Foundry Use .. 179
Molding Machine Practice 183
Casting Iron on Steel 184
Foundry Layout and Construction ... 185
A View of the Foundry at Close Range 188
The Equipment of Air Furnaces Using Oil as Fuel 190
Sulphur and Copper in Lead Alloys 191
Trade Outlook 192
The Pittsburg Convention 192
Book Reviews 193
Obituary 193
Quickly-Made Core Boxes 193
Roll-Over Rock-Down Molding Machine 194
Rat Tails on Stove Covers 195
Drop Bottom Converter 196
Skin Drying Molds 197
Portable Power Squeezer 197
No-Lift Jarring Machine 197
Sand-Handling Plant 198
Mono-Rail Grab Bucket Hoist 199
Waste Sands of the Foundry 200
Drop Plate Molding Machine 200
Slagging a Cupola 200
Trade Notes 201
Trade Publications 201
General Industrial Notes 202

Trade Outlook

No marked change has been noted in foundry trade conditions during the month, although in the leading casting producing centers a heavier tonnage of jobbing work is being offered and in the machine tool districts a slightly improved demand for castings is reported. With few exceptions, steel foundries continue to operate from four to five days per week, while the melt of the malleable shops is variously estimated at from 50 to 60 per cent of capacity. The demand for plumbers' goods is reflected in the activity of the brass shops specializing in this line of work and automobile manufacturers are placing large contracts for their next year's requirements of brass and aluminum castings. When considering the present demand for all kinds of castings, the tremendous increase in producing capacity in recent years should be taken as a modifying factor and in some lines casting requirements are not much below normal based on the manufacturing facilities of several years ago. As predicted, the reduction in the price of ore has not affected pig iron quotations and No. 2 foundry is held as follows: Philadelphia, $15.50; Birmingham, $11; Pittsburg, $14.15; southern, Cincinnati, $14.25; local, Chicago, $15, and northern, Cleveland, $14.25. Quotations on other grades of foundry iron follow: Lake Superior charcoal, $17.50, Chicago; malleable Bessemer, $14.15, Pittsburg; basic, $15, delivered, eastern Pennsylvania points, and $14.40, Pittsburg. There has been little change in copper, lead and spelter, but wide fluctuations have been recorded in the price of tin.

The Pittsburg Convention

Advancement in the art of casting metals was the keynote of the Pittsburg meeting of American foundrymen, and the discussions of technical and practical subjects, as well as the exhibits, foreshadow the passing into history of the time-honored, but shop-worn traditions that retarded progress in the foundry industry for many years. Scientific methods are fast replacing the rule-of-thumb and labor-saving devices are now available for practically every operation of casting production. The array of molding machines displayed has never before been equalled and every conceivable device was shown for reducing molding costs of both small and large castings. Shop transportation and handling facilities are also receiving deserved attention, these mechanical appliances becoming a necessity with the growing use of molding machines of large capacity. From the lighting of the cupola to the pouring of the molds, traditionary practice has been forced to the rear by mechanical appliances that effect great economies in every operation. The skeptic can no longer stay the march of progress in the foundry trade and he must either fall in line or move aside to make room for those who can keep step with the forward movement of the industry. The exhibition hall at Pittsburg was crowded with the tools that have been such potent factors in this advancement and at the meetings of the various educational societies, the methods by which the wonderful results of latter-day foundry practice are achieved, were discussed. Steel and malleable foundry practice were given more attention than at any previous gathering and the papers presented described the methods pursued in some of the largest shops in the country. Every phase of the cost-keeping problem was considered and reasons for failure pointed out. It was made apparent to even the most progressive foundryman that failure is as frequently traceable to the office as to the shop, and that it is as important to modernize his cost-keeping records as his manufacturing equipment. The difficulties of the brass foundryman were discussed in a number of well-prepared papers read before the American Brass Founders' Association and the report of the preliminary investigation of casting temperatures of the non-ferrous metals and alloys should lead to further research that should prove fruitful in results for those engaged in the production of brass, bronze and aluminum castings. The classification of papers bearing on related subjects and their assignment to certain sessions was favorably commented upon and this arrangement of the program resulted in an increased attendance of foundrymen who were only interested in certain topics and whose business affairs did not permit of their presence in Pittsburg throughout the convention week.

Personal

F. G. Coffeer, of Chicago, has been appointed metallurgist of the Globe Malleable Iron and Steel Co.'s foundry, Syracuse, N. Y.

C. W. Lytle, formerly superintendent of the Sharon, Pa., plant of the American Steel Foundries, has been appointed general manager of the Hubbard Steel Foundry Co., East Chicago, Ind.

Almon Emrie, superintendent of the foundry operated by the Link-Belt Co., Chicago, during the past five years, has resigned. His present address is 4652 Woodlawn avenue, Chicago.

H. P. Shaw, formerly sales agent of the American Steel Foundries, is now connected with the Hubbard Steel Foundry Co., in the capacity of sales

manager, with offices at 417 Fisher building, Chicago.

C. P. Karr has been appointed metallurgist and chemist of the Walworth Mfg. Co., Boston, and has entire charge of the metallurgical work of the three foundries operated by this concern.

Charles W. Cade has recently resigned as foundry manager of the Blake & Knowles Steam Pump Works, East Cambridge, Mass., and is at present engaged in consulting work. Mr. Cade's address is 35 Norfolk road, Arlington, Mass.

Henry R. Cobleigh has resigned as mechanical editor of *The Iron Age,* which position he has held for the last seven years, to take charge of the advertising and publicity department of the International Steam Pump Co., 115 Broadway, New York City.

Warren J. Lynch, formerly passenger traffic manager of the Lake Shore & Michigan Southern railroad, has been elected vice president of the American Steel Foundries and will take charge of the sales and traffic department. Mr. Lynch is located in New York City.

F. G. Smith, president of the Osborn Mfg. Co., Cleveland, will return from Europe June 10. While abroad Mr. Smith established a number of foreign agencies for the varied lines of products manufactured by his concern, including foundry supplies, molding machines, etc.

Sol Shaw, who has been connected with the E. P. Allis Co., and the Allis-Chalmers Co., Milwaukee, for the past 25 years, has severed his connection with the Reliance works and accepted a position with the No. 2 plant of the Allis Chalmers Co. at Chicago. Mr. Shaw was president and secretary of the Milwaukee Foundry Foremen's Association for a number of years and is well known in the foundry trade, being one of the pioneers of the steel casting business.

Book Review

The Production of Malleable Castings, by Richard Moldenke; 6 x 9 inches, 132 pages and 35 illustrations; published by the Penton Publishing Co., Cleveland, and supplied by THE FOUNDRY for $3.

This work is the most notable of the recent contributions to foundry literature, and discloses the secrets of the malleable process, which, until recent years, have been known only to those directly engaged in this industry. The author is a metallurgist of wide experience in malleable foundry work and every phase of the process, from the making of the molds to the annealing of the castings, is comprehensively discussed. One of the most important features of malleable work is the melting and this is gone into in great detail, both the air and open-hearth furnace methods being described, with details of furnace construction. Instructions are also included for mixing the charges and calculating the mixtures. These features will appeal to the practical foundryman engaged in malleable work, as success or failure, in the production of malleable castings, is dependent almost entirely on the mixing and subsequent melting of the iron.

One chapter is devoted entirely to the annealing of castings and this step in the manufacture of malleable is

AMOS L. CARLETON

second only in importance to the mixing and melting. The packing of the castings is described in detail and the construction of annealing ovens is shown by plan and sectional drawings. Another chapter treats of the characteristics of malleable fractures and the illustrations of these fractures are from samples gathered by the author during his many years of practical foundry work. While judging by fracture cannot be recommended as good foundry practice, particularly as relating to the grading of pig iron in this way, nevertheless, the fractures of malleables, to foundrymen experienced in this line of work, often reveal defects that cannot be discovered in the chemical laboratory. Methods of testing malleable cast iron are also discussed and the standard specifications for malleable cast iron are likewise included. Every step in the process of malleable manufacture is comprehensively treated, chapters being devoted to the pattern shop, molding methods in the malleable foundry, the use of gas producers in malleable foundries, casting malleable iron, the use of the pyrometer in the annealing room, the cost of malleable castings, etc. The work is one that can be recommended not only to foundry superintendents, foremen and melters, but also to managers and proprietors of malleable works.

Obituary

Amos L. Carleton, founder of the Carleton Foundry Co., Hartford, Conn., died in that city April 22. Mr. Carleton was born in Derry, N. H., in 1847 and after serving his apprenticeship as a molder he established a foundry at Shelburne Falls, Mass. After disposing of his interest in this concern he accepted a position as foreman of the foundry department of the Pratt & Whitney Co., and later established the Carleton Foundry Co., with which he was actively connected until about eight years ago, when he leased his interest and retired from business. A widow and two sons survive him.

J. W. McNoldy, a foundryman of wide experience, died recently at the home of his son in Bloomington, Ill. Mr. McNoldy was born in Altoona, Pa., in 1860, and, after serving his apprenticeship as a molder, was appointed foreman of the foundry of the Chicago & Alton shops and until his recent illness was employed as foreman of the foundry operated by A. L. Ide & Sons, Springfield, Ill.

Quickly-Made Core Boxes.

By Wm. C. Nelson

Referring to the article entitled "Quickly Made Core Boxes" published in the February, 1911, issue of THE FOUNDRY, page 272, it is evident that the author intends the core boxes made in the manner outlined, for such work only, in which form and section are not of much importance. The revolving sander referred to, while smoothing the core box, may answer the purpose satisfactorily, but unless the section of the box is held very carefully against the sander the patternmaker will grind under the line and thus lose the shape of the box. For rough pattern work this method might be advantageous, but on fine work, such as valves, cylinders and small machine parts, these sanders would prove too expensive, unless it is possible that some forms of these sanders could be used many times.

FOUNDRY and PATTERN SHOP EQUIPMENT

Roll-Over, Rock-Down Molding Machine---Pattern-Drawing Machine---Drop Bottom Converter---Power Squeezer---No-Lift Jarring Machine--Sand-Handling Plant--Mono-Rail Grab Bucket

A ROLL-OVER, rock-down molding machine, which embodies many novel features of design and construction, built by the Osborn Mfg. Co., Cleveland, is shown in the accompanying illustrations. The machine is portable, being mounted on four roller-bearing wheels, and is designed to be moved along the sand heap as the day's work progresses. A machine for handling flasks up to 26 x 30 inches and 15 inches deep, having a 10-inch draw, is shown in Fig. 1. In this illustration the pattern for a motor end bracket is mounted on a pattern board which is drawn through the open pattern frame when drawing the pattern from the mold. In its ramming position, the machine is low for the convenience of the operator when making the mold. The pattern frame and pattern-drawing device are mounted on trunnions and the mold is so balanced that it can be readily rolled over by hand. After being rolled over, the mold of the drag Fig. 1, by an automatic locking device which also horizontally locks the mold while it is being rocked down onto the floor. The flask clamped, after ramming the mold, is shown in Fig. 2 and in Fig. 3 the mold is being rolled over by the operator. In this illustration is shown the bottom of the pattern board, which is attached to two upright guides actuated by a lever for drawing the pattern. The flask rolled over and locked in a horizontal position is shown in Fig. 4, and in Fig. 5 the drag half of the mold has been rocked down into its pouring position on the floor. The forward rocking movement is imparted by two arms on either side of the machine mounted on rocking shafts for carrying the mold forward. In its forward movement, the mold is counterbalanced by heavy, adjustable springs, which insure lowering the mold gently onto the floor. While being rocked down into position on the floor, the movement of the rocker arms is such is in pouring position on the floor, ready to receive the cope. The machine is then moved along the floor, the pattern-drawing device, pattern frame and pattern are rocked over, the pattern is raised to its ramming position, as shown in Fig. 1, and the operator can proceed with ramming another mold.

In Fig. 8 is shown a pattern-drawing machine, built by the Osborn Mfg. Co., adapted for drawing patterns, mounted on boards or pattern plates. By the use of this machine the rapping of the pattern is entirely eliminated and, in addition, an absolutely uniform draw is insured, thus obviating the large amount of patching and finishing required, particularly on large molds, having only a slight draft. The machine is almost universal in its application and can be used to advantage in conjunction with jarring machines. In Fig. 8 the device is mounted on a jarring machine table in position on the drag pattern of a large motor end bracket. The pattern

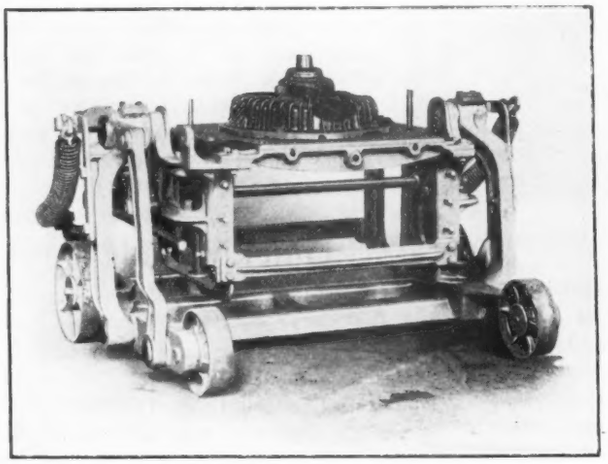


FIG. 1—ROLL-OVER, ROCK-DOWN MOLDING MACHINE IN RAMMING POSITION

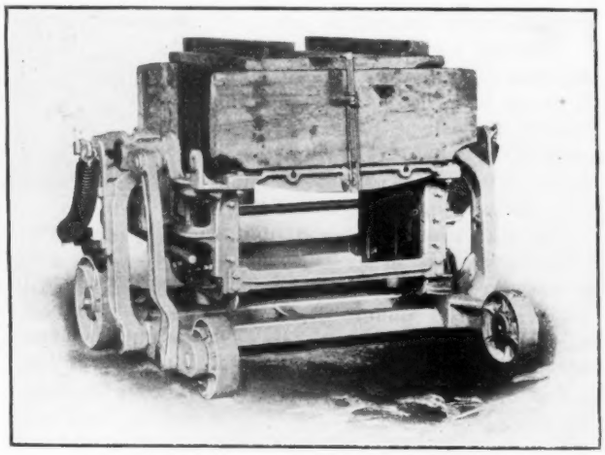


FIG. 2—MOLD RAMMED AND FLASK CLAMPED

half is rocked down into its place on the pouring floor and requires no further handling after being released from the machine. No leveling device is required, as the pattern is drawn from any position, at which the mold may be set when it is rocked down onto the floor. One distinguishing feature that characterizes the construction of this molding machine, is that the pattern is drawn from the mold before the clamps are removed from the flask.

The pattern frame is held in the horizontal ramming position, shown in that the mold is held level throughout this operation.

In Fig. 6 the operator has swung over the pattern-drawing lever, thereby drawing the pattern out of the mold, the pattern board having been drawn through the open pattern frame, which is clearly shown in this illustration. It will also be noted that the mold is still clamped to the pattern frame. After removing the clamps, the pattern frame, pattern-drawing device, etc., are rocked back and assume the position shown in Fig. 7. The drag half of the mold has just been drawn from one of the drags shown in the foreground and was deposited on the jarring machine table by a crane. After jar-ramming the mold and clamping, the mold is lifted from the molding machine table by a crane, rolled over and set on the floor. If the drag, the mold is set in its pouring position. The pattern-drawing machine is lowered over the pattern by a crane, two hooks being provided on either side of the frame to receive the crane hooks or rope sling. The four posts, on which the frame of the

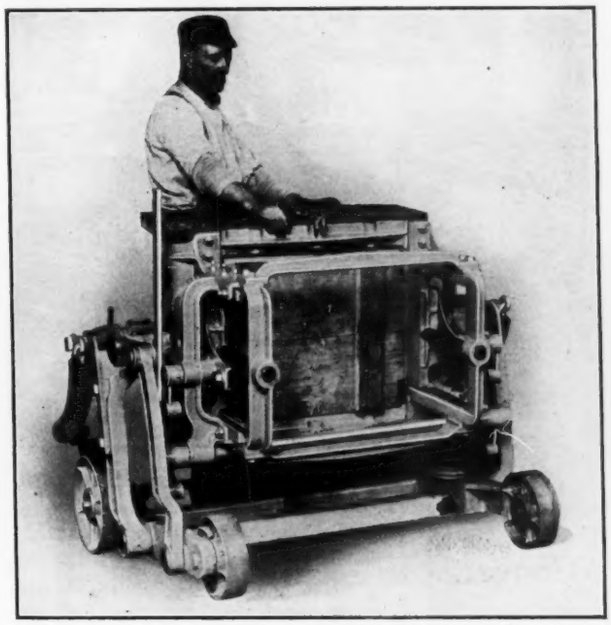


FIG. 3—ROLLING OVER THE MOLD

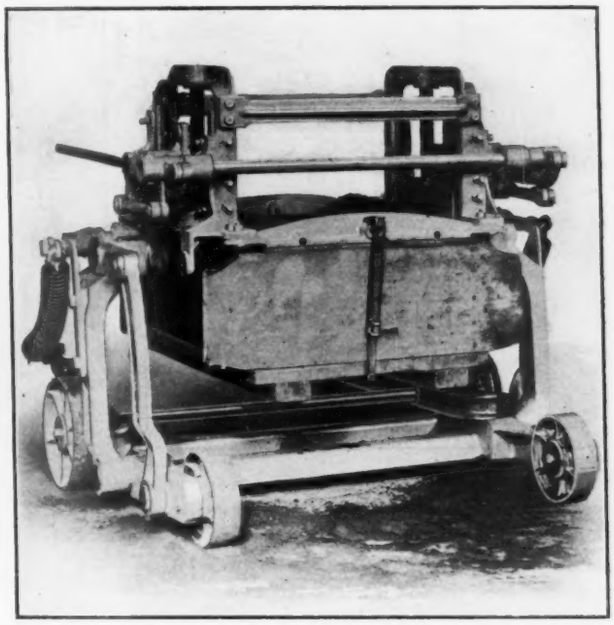


FIG. 4—THE MOLD ROLLED OVER

machine is mounted, pass through openings in the pattern board or plate and rest on the sides of the flask. As the pattern plate, shown in Fig. 8, is circular, recesses have been cut at four points on the circumference of the plate to hold the pattern-drawing machine in position while drawing the pattern. The four posts, on which the frame is supported, serve as guides while the pattern is being drawn. From the frame of the machine depend four hooks which engage pins attached to the sides or circumference of the pattern board or plate. These hooks are attached to the same shafts to which the actuating levers are fastened and by throwing over the two levers, which move in opposite directions, the drawing of the pattern is accomplished. To insure the accurate drawing of the pattern and the simultaneous upward movement of the hooks engaging the pattern plate pins, sheaves connected with a wire rope, are attached to each lever shaft. The rope is locked on each sheave and thereby transmits the movement of one shaft to the other. These machines are built in various sizes for flasks from 18 x 18 inches to 48 x 72 inches, and for 6, 8, 10, 12 and 15-inch pattern draw.

Rat Tails on Stove Covers

By W. J. Keep

Question:—What is the cause of *rat tails* on stove plate and how can this be avoided?

Answer:—For the benefit of foundrymen not engaged in stove plate work, it should be explained that *rat tails* is the term applied to indented lines which occur occasionally on the surface of stove covers and stove tops, which are of course heavier than the other castings from which a stove is assembled. The cause of *rat tails* on stove covers and stove tops in both cases is the same. The larger quantity of iron flowing over the surface of the mold liberates a larger quantity of gas than when the castings are of thin section, and as the surface over which the iron flows is flat, the gas cannot rise into any higher part of the mold. The iron enters the mold through several gates which carry it across the flat surfaces and the iron either circles around and flows back be-

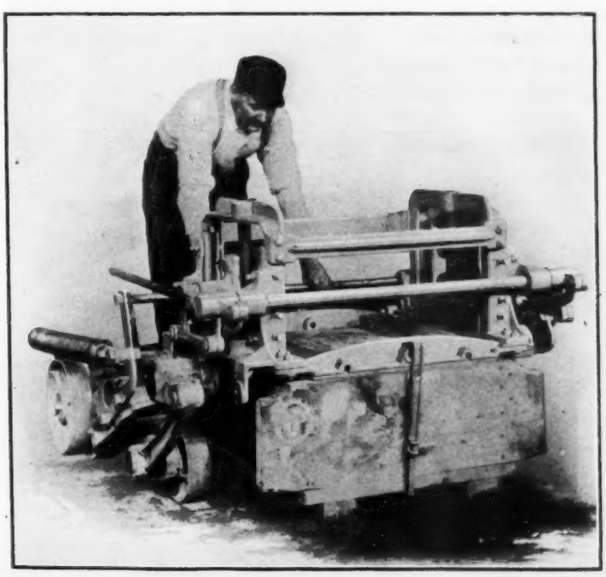


FIG. 5—THE MOLD ROCKED DOWN IN POSITION FOR DRAWING THE PATTERN

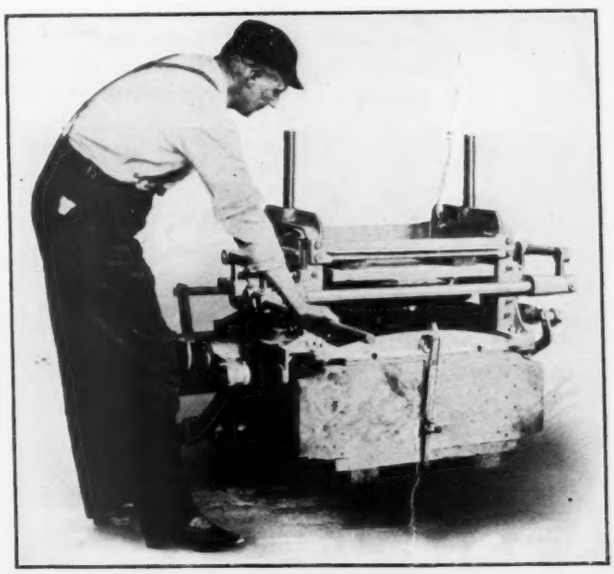


FIG. 6—THE PATTERN DRAWN WHILE THE MOLD IS CLAMPED TO THE PATTERN FRAME

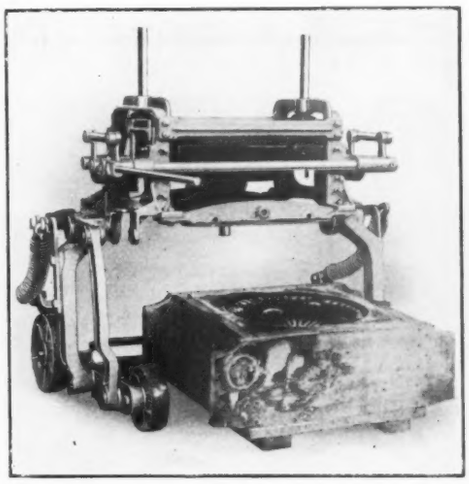


FIG. 7—MACHINE ROCKED BACK, SHOWING THE FINISHED MOLD

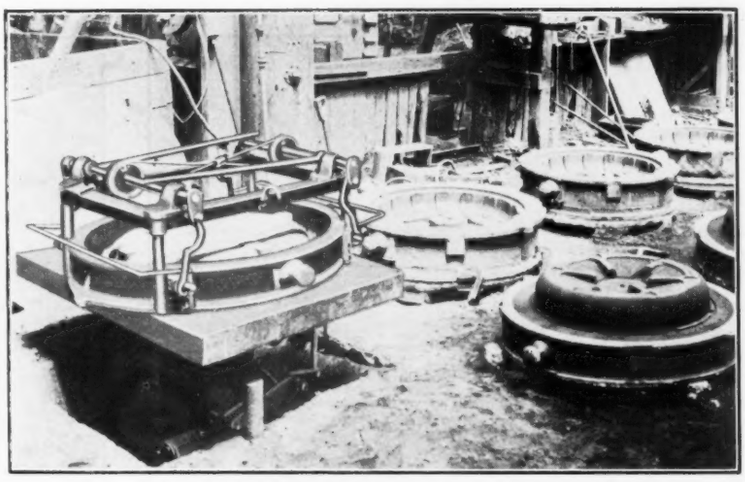


FIG. 8—PATTERN-DRAWING MOLDING MACHINE IN POSITION OVER COPE PATTERN PLATE ON A JARRING MACHINE TABLE

tween the gates or, more frequently, the stream increases in width until the two edges meet. Where the latter occurs, the gas and the sluggish metal prevent the iron from lying close to the mold and a line is left resembling the track of an angle worm on sand. These lines are frequently called *worms*. The remedy is to increase the width of the gates so that the streams of fluid iron unite as they enter the mold and flow across the surface in one stream. This difficulty has also been remedied by tilting the mold, the sprue being located on the lower side. In this case the iron fills the mold across its lower edge and rises uniformly over the entire surface. When casting stove covers, tilting the mold and using the broad gate are not always positive remedies, as the ribs on the cope side cause the iron to swirl. In this case a coarser grade of sand containing a small amount of bonding material which will vent freely should be used. Extra venting will also permit the gas to escape. A continuous gate extending one-fourth the circumference of the cover and the use of coarse sand will prevent *rat tails*.

Drop Bottom Converter

The Tropenas Converter Co., New York City, has recently transformed a crucible steel foundry into a converter shop without suspending operations in any department of the plant. The Union Steel Casting Co., Boston, up to Feb. 21, was engaged in the manufacture of steel castings by the crucible process. Four batteries of furnaces, containing ten crucibles each, were operated. Two of the furnaces were dismantled to permit of the installation of the converter, while the other two remained in operation. On Feb. 23, the converter installation was completed and the first blow was made. One of the principal reasons for changing from the crucible to the converter process was on account of the high cost of the finished product. One of the important considerations connected with this installation involved the quality of the steel castings produced by the converter process. After 100 heats of the baby converter only one casting, weighing a few ounces, was returned. All of the steel thus far made exceeded the required specifications and owing to the fluidity of the metal, exceedingly small and thin sections are being cast in this shop.

In this plant, the Tropenas Converter Co. installed the first of its new type of drop bottom converters. The critic-

Schedule of Converter Heats.

No. of blow.	Blow started.	Blow ended.	Duration of blows, minutes.
1	10:54 a. m.	11:05 a. m.	11
2	11:24 a. m.	11:35 a. m.	11
3	11:57 a. m.	12:08 p. m.	11
4	12:28 p. m.	12:38 p. m.	10
5	12:59 p. m.	1:09 p. m.	10
6	1:30 p. m.	1:40 p. m.	10
7	2:02 p. m.	2:12 p. m.	10
8	2:35 p. m.	2:45 p. m.	11

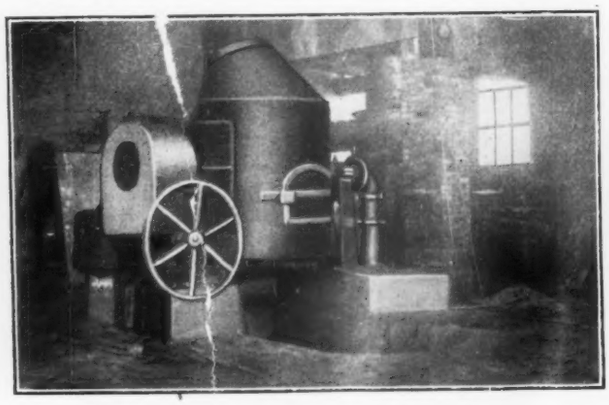


FIG. 1—BABY CONVERTER WITH REMOVABLE BOTTOM, INSTALLED IN THE PLANT OF THE UNION STEEL CASTING CO., BOSTON

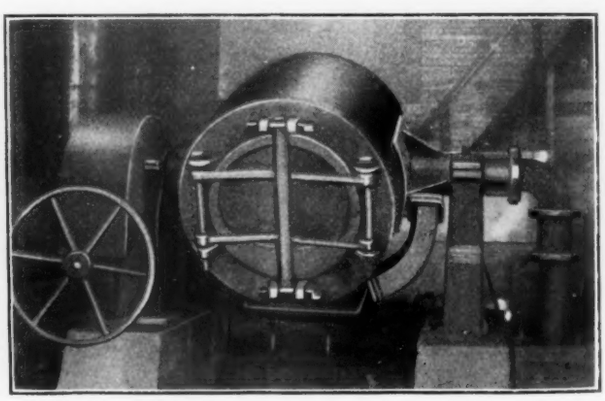
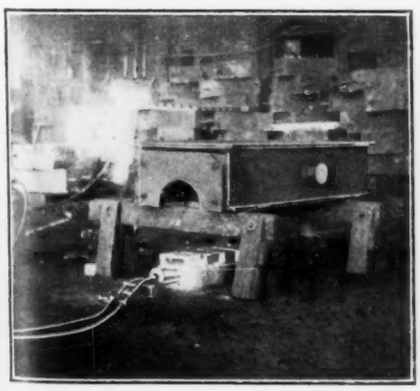


FIG. 2—CONVERTER TILTED, SHOWING THE BOTTOM DOORS

ism has been made that with a one-piece converter it is practically impossible to cool the lining sufficiently after a day's blow, to permit patching the following morning. As a result, foundries, casting daily, have been compelled to install two converters. A. Tropenas, inventor of the Tropenas converter process, designed a double-door bottom for this converter, similar to that used on cupolas. This double door has been tested in Europe and the converter installed in the plant of the Union Steel Casting Co. is the first of its kind to be used in the United States. The converter is shown in Fig. 1 and the vessel tilted, showing the bottom door, is illustrated in Fig. 2. After blowing, the bottom doors are opened and the lining forming the bottom of the converter is knocked out. This opening in the bottom of the vessel permits the air to circulate freely through the converter, which is sufficiently cool the following morning to permit patching. After repairs have been made, the doors are again closed and a special composition lining is rammed on top of the doors. When the converter has been sufficiently heated to receive the iron, the bottom has been entirely dried out. The opening in the bottom of the converter is of sufficient size to permit a man to enter the vessel to make necessary repairs.

The Union Steel Casting Co. makes a specialty of small castings and employs only 12 molders. From 7 to 7:45 in the morning, the converter and cupola are patched and at 7:45 a. m., the fire is started in the converter, and at 8:15 a. m., the fire is started in the cupola. At 10:25 a. m., blast is put on the cupola and at 10:45, the first iron is tapped. The schedule of heats made in the converter is shown in the accompanying table.

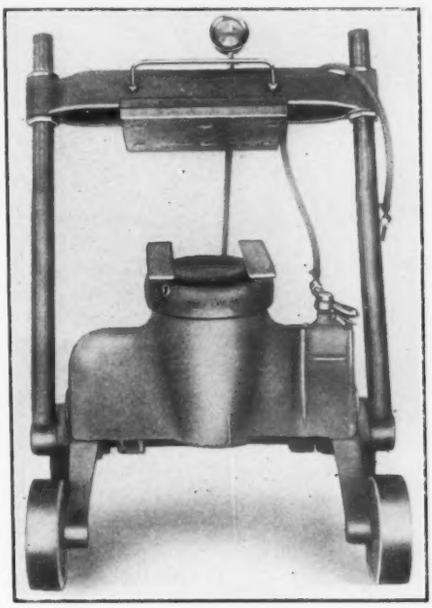


METHOD OF DRYING AN ENGINE BED MOLD WITH A PORTABLE OIL BURNER

At 3 p. m., bottom is dropped, and from 3 to 5 p. m., the molders resume work and the laborers shake-out molds and temper the sand. The approximate capacity of the converter is 1,200 pounds and the amount of steel made daily is 9,600 pounds.

Skin-Drying Molds

The method of skin-drying an engine bed mold with a portable oil burner is shown in the accompanying illustration.



PORTABLE POWER SQUEEZER

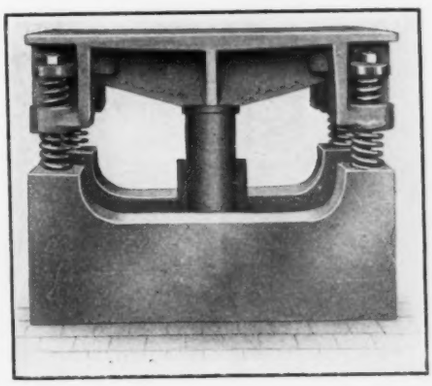
The mold is supported, as shown, and the flame of the burner is directed into a brick channel, from which the heat is deflected to the mold. The time required to dry this mold to a depth of 1½ inches was one hour and the oil consumption was two gallons. These portable burners, which are manufactured by the Hauck Mfg. Co., Brooklyn, N. Y., are also used for skin-drying molds for automobile castings. In one large shop the drag halves of the molds are placed on the floor in position for closing and a sheet iron hood is placed over the mold, after which the copes are set over the drags, the molds being dried by the heat radiated from the hood or box. The actual time required to dry a row of 12 to 16 molds to a depth of ½ to ¾ inch varies from 15 to 20 minutes, the molds varying in size up to 24 x 36 inches.

Portable Power Squeezer

A portable power squeezer, built by the International Molding Machine Co., Chicago, is shown in the accompanying illustration. The machine is mounted on four wheels and can be easily moved along the sand heap. In this way the last row of molds and the machine are kept in close proximity to each other, thereby greatly reducing the distance the operator will have to travel in placing his molds on the floor and carrying the sand. Another feature is the fact that the entire operating mechanism is enclosed within the cylinder frame and is thus never exposed to the sand, nor the wearing action ensuing therefrom. The stops for limiting the movement of the ramming head, when it is swung back, and the spring for counterbalancing the weight of the head are likewise enclosed. The use of a specially designed slide valve permits the ramming of the mold by slow, steady pressure or by a quick, striking blow, as the nature of the work may require.

No-Lift Jarring Machine

A no-lift jarring machine, particularly adapted for ramming cores and molds carrying deep, green sand cores, built by the Osborn Mfg. Co., Cleveland, is shown in the accompanying illustration. This machine is equipped with a table, 24 x 36 inches, and has a capacity for ramming molds weighing 1,000 pounds. The ramming of the mold is accomplished by an air-actuated hammer which operates in a 3-inch cylinder and the only weight raised by the compressed air is that of the hammer or piston, which weighs 40 pounds. The hammer strikes the bottom of the table in the center and the force of the blow is uniformly distributed to all parts of the table, which has been carefully ribbed to insure the equal transmission of the blow. The valve is located in the cylinder. The machine requires no foundation and can be operated on wheels or on the foundry floor. The table is resiliently supported at the corners by four heavy springs.



NO-LIFT JARRING MACHINE

Sand-Handling Plant

The sand-handling equipment furnished to the General Fire Extinguisher Co., Auburn, R. I., by the Jeffrey Mfg. Co., Columbus, O., is shown in the accompanying illustrations. In this plant the molding floor is on a level of what might be termed the second story of the

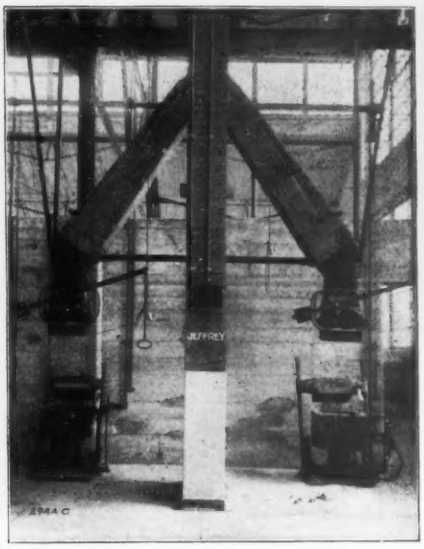


FIG. 1—BIFURCATED SAND HOPPERS OVER EACH MOLDING MACHINE. THIS ILLUSTRATION ALSO SHOWS THE CLAM SHELL VALVES

building, as the first floor or basement is on the same grade as the yard. This arrangement permits the molding sand to be carted in from the yard and to be dumped on the basement floor, as

FIG. 2—THE BOOT OF ONE OF THE ELEVATORS ON THE BASEMENT FLOOR, SHOWING THE HOPPER, INTO WHICH THE SAND IS SHOVELED

shown in Fig. 5. This equipment included 17 bucket elevators for handling molding sand, nine of them being located on one side of the foundry, as

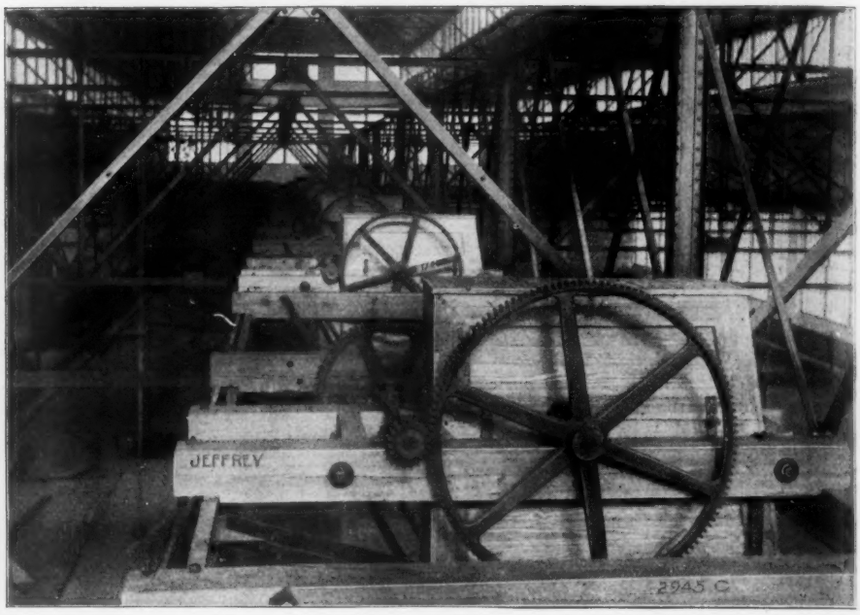


FIG. 3—A VIEW OF ONE OF THE MOLDING FLOORS, SHOWING THE SAND HOPPERS AND ENCLOSED CONVEYORS, AS WELL AS THE GRATINGS, ON WHICH THE MOLDS ARE SHAKEN OUT

shown in Fig. 3, and the other eight elevators have been installed on the opposite side of the shop.

The elevators convey the sand after it has been screened and tempered to the molding machines, located directly underneath the clam shell valves at the bottom of the sand hoppers, as illustrated in Fig. 1. The molding machine operators open the valves of the sand hoppers, which permit the necessary amount of sand to drop by gravity into the flasks, thereby eliminating the shoveling of sand by hand and no space is required for piles of sand on the molding floor near the molding machines.

After the sand is prepared, it is shoveled into the receiving hoppers on the first floor, Fig. 5, and is elevated and discharged to the bifurcated hoppers above the machines, each of which has a capacity of 1,000 pounds of sand. As previously stated, the bottoms of these hoppers are provided with clam shell valves to regulate the discharge of sand to the molding machines, located directly underneath them. Each elevator has a capacity of about 10 tons

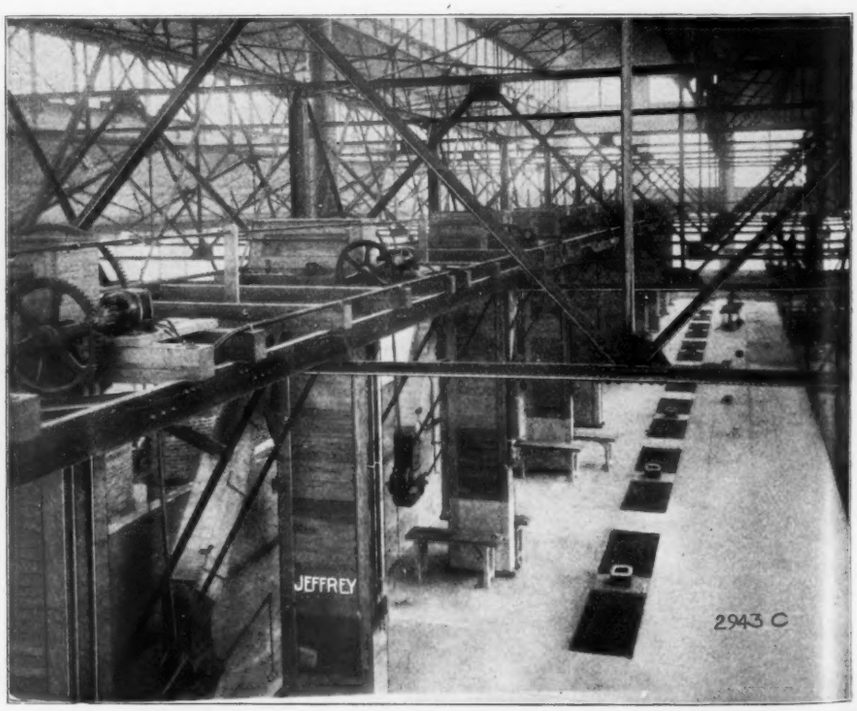


FIG. 4—DRIVING MECHANISM OF THE ELEVATORS WITH MOTORS ENCLOSED

FIG. 5—A VIEW OF THE BASEMENT FLOOR, WHERE THE SAND IS PREPARED

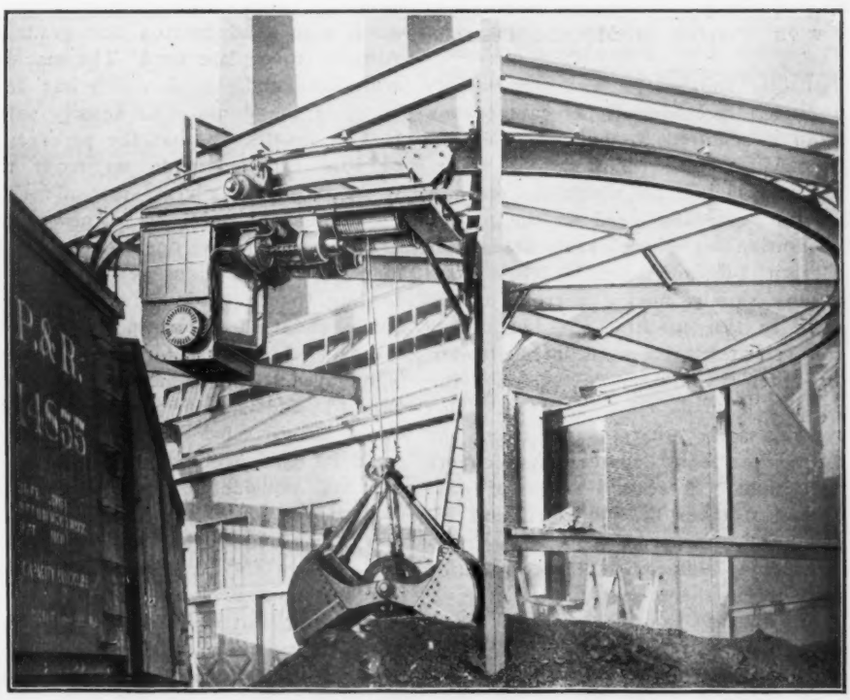
per hour and is operated by an individual electric motor, connected directly to the head shaft by means of gears, as shown in Figs. 3 and 4. The elevators are completely enclosed in a wooden case and the hoppers are of steel construction.

A general view of one of the molding floors is shown in Fig. 3, and after pouring, the castings are shaken out over the gratings, through which the sand falls onto the basement floor underneath, where it is screened and tempered and shoveled into the boots of the elevators, by which it is conveyed to the hoppers that deliver it to the molding machines. The Jeffrey Mfg. Co. has also made a similar installation for handling sand in the General Electric Co.'s foundry at Pittsfield, Mass.

Mono-Rail Grab Bucket Hoist

In the accompanying illustration is shown a mono-rail grab bucket hoist, built by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., and installed in the power plant of the Dill & Collins Co., Philadelphia. This hoist is designed for the rapid and economical handling of coal, crushed rock, sand or any other material which is handled in bulk in the foundry or manufacturing plant. The hoist consists of two independent hoisting units mounted on a structural steel frame connected with a trolley which operates on the lower flange of an I-beam, or mono-rail track composed of T-rails placed on either flange of an I-beam. The hoisting units are enclosed in cast iron cases which likewise form the supports. Planitary gearing is used which, together with the brakes and all bearing surfaces, is partially submerged in an oil bath. The spur gears used are cut from solid blanks, and the bearings are made of hard bronze and are bored to correct location in the hoist frame. Each hoisting unit is equipped with two brakes, mechanical and electric, which operate automatically and will hold the load at any desired point in the line of travel. The trolleys are arranged to swivel and to drive on all four wheels, thus distributing the wear and increasing the tractive power. They are equipped with an electric brake which automatically brings the machine to rest when the power is cut off, and where the service requires, they are equipped with a foot brake with the lever in the operator's cage.

The cage is mounted back of the hoisting motors and is arranged so that the load is always in full view of the operator. Each hoisting unit is independently controlled by its individual controller located in the hoist cage. By this arrangement the loads handled can be controlled according to the requirements of the work. For example, if the bucket is working in especially soft material, the holding line may be tightened while the bucket is closing, thus preventing the bucket from digging so deeply that it will overflow and scatter the material. The two lever systems of control on the grab bucket machine permit each controller to have a maximum number of steps which allow for an ample amount of resistance to be cut out gradually in starting the loads. This feature minimizes the excessive strains which would ordinarily occur when the motor is started quickly. This system of control is also advantageous in that the bucket can be carefully maneuvered when coarse materials are being handled and which are liable to be caught between the bucket jaws.



MONO-RAIL GRAB BUCKET HOIST

Waste Sands of the Foundry*

By S. A. Capron

To foundries in general the securing of a sufficient supply of core sand and the disposal of waste sand are considerable items of expense. To most foundries, on account of their location, this becomes a serious problem. For this reason, any means of reducing the supply necessary has an equal effect on the problem of waste, and works a two-fold economy.

A core sand washing machine in operation at our plant, built by the Osborn Mfg. Co., Cleveland, offers a practical means of securing this economy by cleaning the waste core sand and returning a large part of it as a new supply. The problem of waste is almost entirely eliminated. The washed sand is free from all objectionable substances and satisfactory for use. Not over 20 per cent of new sand is required to maintain the total amount of sand required.

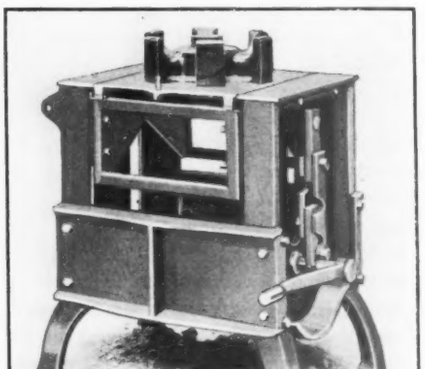


FIG. 1—DROP PLATE MOLDING MACHINE WITH PATTERN IN MOLDING POSITION

The principle on which the machine is constructed is based on the natural separation of sharp sand from any foreign substance which takes place in any slowly moving current of water. In this machine the burnt core sand is first submerged in the water, and then by the action of revolving paddles is made to scour itself. This separates the sharp sand from the burnt core bond coating that covers the grains. A second series of paddles then takes up the work and effects a further separation of the materials, the different specific gravities assisting in the process.

In its progress through the machine the waste is now met by discharge buckets which pass under the lighter flowing waste and gather up the heavier material which consists of the reclaimed core sand. The final waste flows out of the machine as a saturated solution of mud and other foreign matter, including some of the sand which has escaped the discharge buckets. This passes into a two-part settling basin, where a still further separation takes place. From the first partition in this basin is obtained a sand which would be satisfactory for 50 per cent of the cores in any foundry. The settling in the second partition consists wholly of a very fine ground mud; but this is a very small per cent of the total amount washed, generally not over 1 per cent. This is not only a much smaller proportion than is usually obtained, but is a much less objectionable product to dispose of than the ordinary black, dried dust.

The waste water can be used over again or carried direct to the sewer. The matter contained in this waste water is so light and fine that it takes several days for it to settle clear, at the end of which time, if the water is turned off and the waste dried, it will be found that 95 per cent will pass through a very fine riddle. In the operation of this machine 15 or 20 cubic yards of waste material can be handled in 10 hours. The production of perfect core sand from this amount will vary from 80 to 90 per cent. The balance is recovered in the settling basin, and brings the total available sand up to about 95 per cent.

By passing used molding sand through the machine it has been found possible to separate 25 per cent of good core sand from a fine grade of Albany stove plate sand. The machine will also handle sand which has been lying in the dump with equally satisfactory results, so that the percentage of loss can be made up from the waste of previous years instead of by the immediate purchase of new sand.

The machine is operated at from nine to 15 revolutions per minute, according to the grade of sand, and requires about three horsepower at these speeds. About 10 cubic feet of water is required to the cubic yard of waste handled and an arrangement could easily be perfected whereby the water could be used over again if it were an item of considerable expense. The construction of the machine is such that it can readily be made a part of any design for a continuous sand-handling unit, as it requires no regulation after starting the water in the sand, or it may be used as a unit by itself and the waste fed into the machine at irregular intervals, or shoveled into the hopper by hand.

*Presented at the Pittsburg convention of the American Foundrymen's Association.

Drop Plate Molding Machine

In the accompanying illustrations is shown a drop plate molding machine, built by the Osborn Mfg. Co., Cleveland, which is particularly adapted for molding deep patterns having only a slight draft. This machine can take flasks 16 inches wide and 36 inches long and has a 10-inch draw. In Fig. 1, the pattern is shown in molding position, and in Fig. 2, the pattern plate has been lowered, drawing the pattern out of the mold. The frame to which the pattern plate is attached is raised and lowered by the movement of a lever attached to a shaft which actuates compound toggles on either side of the machine. The frame, to which the pattern plate is attached, operates in V-ways, adjustable to take up wear, which insure an absolutely straight draw. The frame is of the box type and contains no mechanism underneath the pattern plate, thereby providing ample space for stooling. The sliding plates on top of the frame are adjustable for various lengths and widths of flasks. As the two sides of the frame are open, flasks of any length up to 36 inches, can be handled on this machine. All of the operating parts are amply protected from the sand, and if desired, the ends can be enclosed as a further precaution. The machine is mounted on four legs with ball feet.

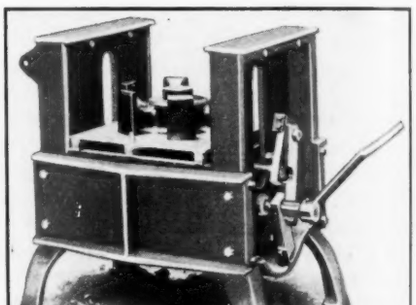


FIG. 2—DROP PLATE MOLDING MACHINE, SHOWING PATTERN DROPPED AWAY FROM THE MOLD

Slagging a Cupola

By W. J. Keep

Question:—Our two cupolas are 29 inches and 39 inches in diameter, respectively, inside the lining. They are equipped with two rows of tuyeres and each furnace is driven by a fan of sufficient capacity for a 46-inch cupola. After the blast has been on about an hour the rate of melting gradually decreases and after five or six hours we are unable to obtain iron. When the

bottom is dropped we find that the charges have bridged in the cupola. During the last four hours the amount of iron melted is comparatively small as compared with that obtained during the first hour. We do not slag our cupolas.

Answer:—The remedy is to slag the cupolas and to exercise great care in charging. Undoubtedly you charge large pieces of scrap. While you do not say so, you probably catch your iron in a large mixing ladle at each cupola. Endeavor to obtain white limestone containing about 85 per cent of lime. Do not use limestone containing only 40 per cent of lime and 30 per cent of magnesia. The slag hole should be located about 4 inches below the lower tuyeres and not less than 8 inches above the sand bottom. After tapping four or five charges, the slag hole may be opened, but if the slag does not flow it should be closed and the cupola should be slagged off later. In this way you can learn when to open the slag hole. After the slag begins to run keep the slag hole open throughout the remainder of the heat. Break your scrap as small as your pig iron, and charge uniformly. Also avoid charging dirt from the charging platform. Screenings and shot iron should be charged early in the heat and dirt and sweepings should never be charged into the cupola. The limestone should be broken into small pieces the size of an egg, and on top of each charge of coke 20 pounds of limestone should be added for each ton of pig iron which is to follow. We would suggest that you close the upper row of tuyeres so as to confine the melting to the lower part of the cupola. If you keep the slag running you can melt continuously throughout the day. When repairing the cupola if any portion of the lining is badly burnt out replace the bricks instead of plastering clay mixed with broken brick over this section. This sooner or later falls out and must be melted and run off as slag. Use just enough daubing to smooth the surface of the lining.

Trade Notes

The Sprague Electric Co. has removed its Bostson office from the Weld building to larger quarters at 201 Devonshire street.

The Roller Sand Mixer described in the May issue of THE FOUNDRY, page 140, is built by the J. W. Paxson Co., Philadelphia.

The Canadian Steel Foundries, Ltd., Welland, Ont., is extending its steel foundry and would like to receive catalogs from manufacturers of foundry equipment and supplies.

The Sterling Steel Foundry Co. announces the removal of its Pittsburg office, formerly located in the Frick building, to its works at Braddock, Pa.

The Chicago office of the Whiting Foundry Equipment Co., Harvey, Ill., has been removed from 1547 to 1245 Marquette building. P. A. Dratz and R. H. Bourne are in charge.

The New York office of the Detroit Steel Products Co., Detroit, has been removed from No. 2 Rector street to 225 Fifth avenue. Raymond H. Kinnear is manager in charge of this office.

The Hooper-Falkenau Engineering Co., 165 Broadway, New York City, has been organized to take over the business of George K. Hooper, industrial engineer. Mr. Falkenau was formerly associated with the Falkenau-Sinclair Machine Co., Philadelphia, of which he was president for a number of years.

Alfred Field & Co., 93 Chambers and 75 Reade streets, New York City, is offering to the foundry trade wax wire for venting cores, which is extremely flexible and can be used in the most intricate cores without cracking or breaking. It is claimed that this wire melts readily and will evaporate quickly.

The Richards-Wilcox Mfg. Co., Aurora, Ill., manufactures an overhead trolley especially adapted for foundry use, which consists of several sizes of trolley track, and trolley carriers in varying capacities from 300 to 4,000 pounds. The system is very complete and, in addition to the straight track, switches, curves and turn-tables are furnished.

The S. J. Peterson Co., Chicago, manufacturer of core binders, including core and linseed oil, dry compound, rosin, etc., has purchased a site adjoining its present plant, upon which will be erected a three-story concrete fireproof building which will be equipped with modern grinding machinery for the manufacture of dry core compound.

The Cleveland-Osborn Mfg. Co., 202-204 Center street, New York City, has been incorporated by the Osborn Mfg. Co., Cleveland, and will maintain a manufacturing plant and warehouse, in which will be carried a complete line of foundry supplies to meet the prompt requirements of the foundry trade in the east. F. D. Jacobs, second vice president of the Osborn Mfg. Co., is in charge of this eastern branch. The Osborn Mfg. Co. has also purchased the plant and equipment of the American Wire Brush Co., New York City, and will continue the manufacture of the extensive line of brushes made by this concern.

The Universal Vanadium Co. has been organized for the purpose of acting as selling agent for the American Vanadium Co., Pittsburg, and will serve in this capacity in conjunction with the Vanadium Sales Co. of America, both concerns thus taking charge of the entire product of the American Vanadium Co., of Pittsburg. The officers and directors of the Universal Vanadium Co. are as follows: Edward M. McIlvain, president; Col. Millard Hunsiker, vice president; James C. Gray, secretary and treasurer; Joseph W. De Wyckoff, European representative, and E. Marshall Fox, Sylvester D. Townsend Jr., and William McIlvain, directors.

Trade Publications

AIR COMPRESSORS.—In Bulletin No. 204, the Thos. H. Dallett Co., Philadelphia, illustrates and describes its line of air compressors, including compound steam two-stage air machines. In another bulletin duplex and compound belt-driven air compressors are described.

WHEELBARROWS AND TRUCKS.—The J. W. Paxson Co., Philadelphia, manufacturer of foundry supplies and equipment, in a 20-page bulletin recently issued, illustrates and describes an extensive line of wheelbarrows and trucks adapted for use in foundries, steel works, at blast furnaces, etc.

PATTERN SHOP EQUIPMENT.—The Oliver Machinery Co., Grand Rapids, Mich., has issued a 448-page catalog, illustrating and describing its extensive line of pattern shop and wood-working equipment. This includes the universal saw bench, variety saw table, single arbor rip and cut-off saw, hand-feed rip saw, self-feed rip saw, heavy swing cut-off saw, band saws, scroll saws, surfacers, planers and jointers, lathes, etc. In addition, this concern manufactures disk sanders, wood trimmers, grindstone frames, emery grinders, glue heaters, woodworkers' benches, woodworkers' vises, clamps, trucks, etc. Among the pattern shop supplies shown are dowel pins, pattern letters, leather fillet, revolving fillet and dowel racks, rapping plates, diamond pattern lumber, etc.

GAS-DRIVEN LOCOMOTIVES.—In a 24-page bulletin the Milwaukee Locomotive Mfg. Co., Milwaukee, illustrates and describes its mining type of gas-driven locomotives adapted for use in mines, tunnels, industrial plants, brick and cement works, etc. These locomotives are equipped with 4-cylinder engines, designed to operate on gasoline, alcohol, kerosene or distillate. The radiators are constructed of copper and brass with sufficient water capacity to keep the engine from overheating when operating under full load. The fuel tanks are made of seamless drawn steel or copper and are equipped with safety valves which serve to prevent leakage. The locomotive is equipped with a specially designed muffler fitted with a fine mesh wire screen, so arranged that fire cannot escape to the atmosphere. For underground work these locomotives are equipped with galvanized steel chemical tanks, fitted with a series of parallel pipes which are immersed in a chemical solution. The exhaust gases emitted by the engine pass through the pipes, emerge to the chemical solution in small jets and are effectively extinguished.

GENERAL INDUSTRIAL NOTES

The Weisenborn Mfg. Co., Houston, Tex., contemplates the erection of a foundry, 100 x 100 feet, and a machine shop, 100 x 200 feet.

The Schuylkill Haven Foundry Co., Schuylkill Haven, Pa., has been incorporated with a capital of $60,000 and will make a specialty of cast iron soil pipe.

The Furnace Equipment Co., Maryville, Tenn., has succeeded the Maryville Foundry and will engage in the manufacture of the Naughton grate bar.

The Ames Plow Co., Boston, contemplates the removal of its entire plant now located at Worcester, Mass., to South Framingham, the latter part of this year.

The South Side Foundry Co., Port Washington, Wis., recently incorporated, is erecting a foundry, 60 x 120 feet and a machine shop and cleaning department, 20 x 66 feet.

The S. J. Gardner Foundry & Machine Co., New Albany, Ind., has been incorporated with a capital of $50,000. The incorporators are S. J. Gardner, Frank S. Sisloff and M. C. Gardner.

The U. G. Augustine Foundry & Mfg. Co., Los Angeles, has been incorporated with a capital of $50,000. The incorporators are W. G. Augustine, J. E. and J. G. Hoyal, M. and L. M. Augustine.

M. C. Carrigan & Son, operating the Montrose Iron & Brass Foundry, have removed their plant, formerly located at Anadarko, Okla., to Montrose, Colo., where they will engage in the manufacture of iron and brass castings.

The S. J. Gardner Foundry & Machine Co., New Albany, Ind., has been organized to succeed S. J. Gardner and has installed two five-ton power traveling cranes, one six-ton hand traveling crane, and one 42-inch and one 36-inch cupola.

The Los Angeles Brass Mfg. Co., Los Angeles, is a merger of the Los Angeles Brass Works and the Liebfried Brass Mfg. Co., both of Los Angeles, and will engage in the manufacture of chandelier fittings and general brass goods.

The new foundry of the Hess Steel Castings Co., Bridgeport, N. J., has been placed in operation. The process employed is a novel one, having originated with the Flexilis Werke of Germany, and it is claimed effects great economies in the production of automobile and engine parts, high-pressure piping and other intricate shapes not justifying the use of dies.

The foundry business heretofore conducted under the firm name of Forster, Waterbury & Co., Franklin Park, Ill., will hereafter be conducted by the Franklin Park Foundry Co., with general offices at Herrs Island, Pittsburg. Chas. F. Forster has sold his entire interest in the corporation of Forster, Waterbury & Co., and has resigned as treasurer and general manager of this concern.

The Atlas Steel Casting Co., Buffalo, has been incorporated with a capital of $100,000, and will engage in the manufacture of steel castings by the acid open-hearth process. A plant of steel and concrete construction is being erected, consisting of two buildings, 130 x 160 feet and 50 x 160 feet, respectively. The officers are: G. H. Chisholm, president; E. C. Strong, vice president, and F. C. Gratwick, general manager.

The United Patents Mfg. Co., Pittsburg, has acquired the plant of the Pittsburg Fuse Co., which is located at Callery, Pa., and has been idle for some time. The plant consists of eight buildings and the new owners will make improvements and install machinery suitable for the manufacture of stamped sheet and copper products. One of the buildings will be equipped as a foundry for the manufacture of small malleable castings. J. H. McKinney is president and H. McKinney is secretary.

The consolidation of the Bucyrus Steel Castings Co. and the Carroll Foundry & Machine Co., Bucyrus, O., was effected April 1. The former concern absorbed the latter, but the consolidation will be known as the Carroll Foundry & Machine Co. The capital stock will be increased from $200,000 to $500,000. The former officers of the Bucyrus Co. will hold the same position with the new concern, as follows: President and manager, P. J. Carroll; vice president, F. P. Donnenwirth; secretary and treasurer, W. A. Blicke.

The Union Steel Casting Co., Pittsburg, is erecting a new plant on property recently acquired adjoining its present foundry at Sixty-first and Butler streets. The main building will cover 80,000 square feet and will be equipped with two acid-lined, 25-ton Swindell furnaces. The foundry will be served by two 35-ton, two 25-ton, one 20-ton, six 10-ton, and two 5-ton Morgan electric travelling cranes. This concern specializes in cast steel locomotive frames, driving wheel centers, annealing boxes, rolling mill machinery castings, etc.

The Keystone Bronze Co., Pittsburg, has taken over the brass, bronze and copper business of the Brighton Brass & Bronze Co., New Brighton, Pa., and the bronze and copper department formerly operated by the Best Mfg. Co., Pittsburg. These departments will be operated in conjunction with the Keystone foundry and will greatly increase the company's facilities for the production of brass, bronze and aluminum castings. This concern specializes in brass and copper furnace tuyeres, coolers and bosh plates, bearings for rolling mills, valves and acid-proof castings.

New Construction.

The Washington Iron Works, Seattle, has in course of construction a reinforced concrete foundry, 120 x 160 feet.

The Hunt-Spiller Mfg. Corporation, 383 Dorchester avenue, Boston, will erect a new foundry, 40 x 100 feet.

The Jungers Stove & Range Co. will erect a stove foundry, in addition to several other buildings, at Grafton, Wis.

The Silver Mfg. Co., Salem, O., is erecting a foundry, 54 x 116 feet, which will greatly increase its output.

The Cincinnati Steel Foundry Co., Cincinnati, will erect a brick and steel foundry on Spring Grove avenue.

The H. L. Dixon Co., Carnegie, Pa., is enlarging its foundry by the erection of a 50 x 50-foot addition.

The American Brake Shoe & Foundry Co. will erect a foundry, 138 x 238 feet, at Twentieth street and Forty-fifth avenue, Chicago.

The Soo Railway Co. will erect a one-story brick and steel foundry on Twenty-ninth avenue S. E. and Quincy street, Minneapolis, at an estimated cost of $18,000.

The Syracuse Malleable Iron Co., Syracuse, N. Y., will erect a foundry on North Geddes street. The building will be 150 x 200 feet and will cost approximately $25,000.

The Modern Foundry Co., Cincinnati, will erect a one-story addition to its plant, of brick and steel construction, at an estimated cost of $25,000.

The Johnston Harvester Co., Batavia, N. Y., is enlarging its malleable iron department by the erection of two additional buildings, each 70 x 500 feet.

The Riverside Steel Foundry Co., Riverside, Cal., recently incorporated, contemplates the erection of a new plant which is the first of a series to be erected by this concern.

Rowland, Firth & Son, Phillipsburg, N. J., founders and machinists, will erect a 10-ton, open-hearth steel foundry, including three buildings, 41 x 101 feet, 60 x 101 feet and 30 x 40 feet, respectively.

The Washington Iron Works, Seattle, has under construction a concrete foundry, 120 x 160 feet, which will be served by a 12-ton crane, 40-foot span, supplemented by several jib cranes and a trolley system.

The new foundry owned by Parker & Topping, Brainerd, Minn., will be placed in operation about June 1, employing a force of 200 to 300 men. This concern has secured the contract for all the castings required by the Northern Pacific railway.

Among the Brass Founders.

The Yale & Towne Mfg. Co., Stamford, Conn., will erect a seven-story brass foundry.

The Brandt-Dent Co., Watertown, Wis., will enlarge its plant by the addition of a brass foundry.

The Peninsular City Casting Co., Bayonne, N. J., is operating a brass foundry at 13 West Ninth street, and will make brass, bronze, and composition castings.

The Charlotte Brass Works, Charlotte, N. C., has been established at 508 West Fourth street, by J. B. Bradford, who purchased the equipment of the Fielding Brass Co.

The Osborne & Stevenson Mfg. Co., Plainville, Conn., started a brass foundry in connection with their plant. It will be under the supervision of Luke H. Carter.

The Wells & Burgess Brass Co., Chicago, has been incorporated with a capital stock of $16,000. The incorporators are B. Wells, W. S. Burgess and A. T. Carton.

The Bridgeport Coach Lace Co., Bridgeport, Conn., manufacturer of automobile and carriage trimmings, will add a small brass foundry to its plant, and would like to receive catalogs of brass foundry equipment.

The Westfield Foundry & Valve Co., Westfield, Mass., has been incorporated with a capital stock of $55,000 and will engage in the manufacture of brass and iron valves. A brass foundry, 60 x 70 feet, will be built. C. O. Churchill is president and secretary, L. Holst, vice president, and R. H. White, treasurer.

The Detroit Foundry & Mfg. Co., Detroit, has been incorporated with a capital stock of $50,000 and will engage in the manufacture of brass and aluminum castings for automobiles. A building has been leased at 13 Macomb street. J. T. Rich is president; Dr. D. A. MacLachlan, vice president; J. Palmer Jr., secretary, and G. E. Lawson, treasurer.

The Fostoria Aluminum Mfg. Co., Mishawaka, Ind., is enlarging its plant by the addition of a foundry 65 x 95 feet, and an office and pattern storage building. The foundry equipment includes oil burning furnaces, core ovens, molding machines, and a plating and polishing outfit. The daily capacity of the foundry will be 2,500 pounds of aluminum castings.

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RICHMOND, VA., Smith - Courtney Co.
BIRMINGHAM, ALA., Dewstoe Machine Tool Co., Brown-Marx Bldg.
DENVER, Hampson-Fielding Engr. Co., 1711 Tremont St.
WASHINGTON, D. C., H. A. Gillis, Home Life Bldg.
SALT LAKE CITY, F. E. Arnold, Atlas Block.

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MONTREAL, Dominion Foundry Supply Co., 47 Murray St.
WINNIPEG, J. A. McTaggart & Co.
EDMONTON, ALTA., Gorman, Clancey & Grindley Co.
MEXICO CITY, Mexican Steel Products & Machinery Co.
MONTEREY, MEX., Sanford & Cia.
LONDON, ENG., J. W. Jackman & Co., Ltd., Caxton House, West
PHILADELPHIA, PA., J. Jacob Shannon & Co., 1744 Market St.

Index to Advertisements

Adams-Bagnall Electric Co., The..... 165
Adams Co. 30, 31
Addy, Matthew, & Co..... 190
Ajax Metal Co..... 184
Albany Sand & Supply Co..... 51
American Air Compressor Works..... 177
American Blower Co..... 66
American Compressor & Pump Co..... 182
American Lumber & Mfg. Co..... 177
American Vanadium Co..... 49
Arcade Mfg. Co.....26, 27
Ardelt & Sons, R..... 166
Atlas Car & Mfg. Co..... 181

Baird & West..... 190
Barnett, Oscar, Foundry Co..... 173
Barry & Zecher Co..... 177
*Bartley, Jonathan, Crucible Co..... 60
Berkshire Mfg. Co.....28, 29
Bessemer Coke Co..... 188
Best, W. N..... 152
Betton, J. M..... 160
Birkenstein & Sons, S..... 182
Blackwell, Geo. G., Sons & Co., Ltd..... 184
*Blake, Geo. F., Mfg. Co..... 176
Blystone Mfg. Co..... 172
Brass Founders' Supply Co..... 174
Breen, Wm. J., Co..... 190
*Bretaud, J. V..... 163
Brown Hoisting Machinery Co..... 139
Brown Specialty Machinery Co..... 12
Buch's Sons Co., A.....34, 35
Buckeye Products Co..... 163
Buffalo Forge Co..... 156
Burdick & Son 171

Carborundum Co. 65
Champion Machine & Forging Co..... 178
Chase Fdy. & Mfg. Co..... 147
Cheney & Sons, S..... 178
Chisholm & Moore.....Insert
Clark Cast Steel Cement Co..... 164
Cleveland Blow Pipe & Mfg. Co..... 182
Cleveland Crane & Engineering Co..... 147
Cleveland Galvanizing Works..... 162
Cleveland Nickel Works..... 43
Cleveland Pneumatic Tool Co..... 171
Cleveland Wire Spring Co..... 46
Coates Clipper Mfg. Co..... 158
Cohutta Talc Co..... 178
Combined Foundry Supply Co..... 165
Connersville Blower Co..... 156
Crescent Machine Co..... 177
Curtis & Co. Mfg. Co..... 145
Curtius, Thos. M..... 178

Damascus Bronze Co..... 184
Davis, Geo. C..... 182
*Deane Steam Pump Co..... 174
Debevoise-Anderson Co..... 190
Detroit Core Machine Co..... 171
Detroit Foundry Supply Co..... 6
Detroit Screw Works..... 172
Dixon, Joseph, Crucible Co..... 53
Dobson, William 179
Donald, Henry R., Sales Co..... 164

Eastern Machinery Co..... 178
Electric Controller & Mfg. Co.....Insert
Electric Smelting & Aluminum Co.....
.....Inside front cover
Engineers' & Founders' Laboratory..... 182
Euclid Crane & Hoist Co..... 178

Federal Foundry Supply Co..... 48
Fernando, W. A..... 52
Field, Alfred, & Co..... 168
Ford Chain Block Co..... 147
Foundry Equipment Co..... 152
Franklin Silica Sand Co..... 16
Freeman Pattern Works..... 177

Gardner Foundry & Governor Co..... 158
Gautier, J. H., Co..... 58
General Electric Co..... 157
Goodrich, F. A., & Co..... 190
Graceton Coke Co..... 188
Gregg Mfg. Co..... 169
Gulick-Henderson Co. 182

Hanna Engineering Works..... 39
Hanna, M. A., & Co..... 191
Harbison-Walker Refractories Co..... 50
Hauck Mfg. Co..... 164
Hawley Down Draft Furnace Co..... 68
Herman Pneumatic Machine Co..... 37
Hill & Griffith Co..... 5
Hillman, J. H., & Son..... 190

Ideal Furnace Co..... 169
Independent Pneumatic Tool Co..... 158
Ingersoll-Rand Co. 17
International Molding Machine Co....18, 19
Interstate Sand Co..... 176

Johns-Manville Co., H. W..... 164
Josef Mfg. Co., E. E..... 179

Keep, W. J..... 182
Kelly, T. P., & Co..... 173
Killing's Molding Machine Works, E..... 26
Knickerbocker Co. 181
*Kroeschell Bros. Co..... 153

Lawlor Improved Jarring Molding Machine
Co., J. J.....32, 33
Lord & Burnham Co..... 154
Lupton's Sons Co., David..... 47

Manufacturers Brush Co., The..... 159
Maris Bros. 141
Masek, C., Glue Co..... 178
Maurer, Henry, & Son..... 189
McCormick, J. S., Co..... 162
McCullough-Dalzell Crucible Co..... 56
McKeefrey & Co.....187, 190
McPhee, Hugh 167
Metallurgical Laboratory 182
Midland Machine Co..... 167
Midvale Mining & Mfg. Co..... 185
Millett Core Oven Co..... 168
Mills, C. E., Oil Co..... 14
Milwaukee Correspondence Schools..... 61
Modern Systems Correspondence School.. 183
Mohr, J. J., & Son..... 191
Monarch Engineering & Mfg. Co..... 69
Morgan Engineering Co..... 139
Morner & Smith..... 172
Mott Sand Blast Mfg. Co..... 160
Mumford Molding Machine Co..... 20

Nash, Isham & Co..... 190
National Brake & Electric Co..... 161
National Core Oil Co..... 4
New Era Luster Co..... 165
New Era Mfg. Co..... 183
Newport Sand Bank Co..... 176
Northern Engineering Works.....Back cover
Norton Co. 64
Norwalk Iron Works Co..... 154

Obermayer, S., Co..... 163
Ohio Mfg. Co..... 179
Ohio Sand Co..... 176
Oliver Machinery Co..... 7
Osborn Mfg. Co.....24, 25
Otis Steel Co., Ltd..... 179
Ottawa Silica Co..... 173

Paige Retort & Crucible Co..... 59
Pangborn Company, Thomas W...Front cover
Pawling & Harnischfeger Co..... 145
Paxson, J. W., Co..... 2
Perry Iron Co..... 191
Peterson Co., T. J.....8, 9
*Pettinos Bros. ..... —
Phosphor Bronze Smelting Co..... 185
Pickands, Mather & Co.....186, 190
Pilling & Crane.....190, 191
Piqua Blower Co..... 67
Piqua Flour Co..... 168
Pittsburgh Emery Wheel Co..... 45
Pittsburg Pneumatic Co..... 177
Pridmore, Henry E.....Insert
Primos Chemical Co..... 184

Randall Tramrail Co..... 143
Richards-Wilcox Co. 145
Ridgway, Craig, Son & Co..... 143
Riehl Mfg. Co..... 160
Robeson Process Co..... 13
Rockwell Furnace Co..... 153
Rockwell Co., W. S..... 152
Roessler & Hasslacher Chemical Co....183, 185
Rogers, Brown & Co.....190, 192
Roots, P. H. & F. M., Co.....Insert
Ross-Tacony Crucible Co..... 54
Royal Ventilator Co..... 157
Ruthenberg, Marcus 70

Samuel, Frank 190
Sand Mixing Machine Co..... 41
Seidel, R. B., Inc..... 57
Sellers, Wm., & Co., Inc..... 42
Shanafelt Mfg. Co..... 15
Shelton Metallic Filler Co..... 62
Shepard Electric Crane & Hoist Co..... 141
Shore Instrument & Mfg. Co..... 175
Shuster, F. B., Co..... 159
Silliman, John 191
"Sirocco" Engineering Co..... 66
Sly, W. W., Mfg. Co..... 71
Smith, J. D., Foundry Supply Co..... 38
Smith, Rudy & Co..... 182
Smooth-On Mfg. Co..... 63
Sprague Electric Co..... 147
Standard Linseed Co..... 171
Standard Pattern Works Co..... 177
Standard Sand & Machine Co..... 40
Sterling Wheelbarrow Co..... 44
Stevens, F. B.....Inside back cover
Stoughton Engineering Co..... 150
Stow Mfg. Co..... 138
Sturtevant, B. F., Co..... 155
Sullivan Machinery Co..... 157

Tabor Mfg. Co.....21, 22, 23
Taylor, Robt. J., Inc..... 55
Thomas Furnace Co..... 190
Thompson & Co., Inc., Lewis..... 177
Thompson & Co..... 168
Tilghman-Brooksbank Sand Blast Co..... 161
Titanium Alloy Mfg. Co..... 185
Toledo Bridge & Crane Co..... 141
Toledo Wheelbarrow Co..... 175
Tropenas Converter Co..... 151
Turner Machine Co..... 174
Tuscora Sand & Coal Co..... 175

United Compound Co..... 168
Uraniumite Co., The..... 183
U. S. Electrical Tool Co..... 159

Valentine, M. D., & Bro. Co..... 189
Van Wicklin, J. G..... 176

Wadsworth Core Mach. & Equip. Co., The.10, 11
Walter-Wallingford & Co..... 190
Wellman Pattern Supply Co..... 169
Wentworth Institute 176
Whitehead Bros. Co. 3
Whiting Foundry Equipment Co.....72, 137
Whitney-Kemmerer Co. 189
Wilbraham-Green Blower Co..... 155
Wise, J. B..... 152
Wonham, Sanger & Bates..... 189

Yale & Towne Mfg. Co..... 183
York Pattern Works 177

Zippler, Francis J..... 152